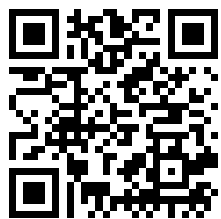

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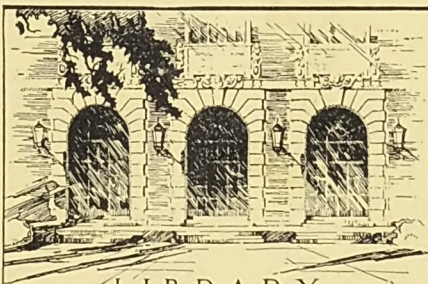
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FIELD-MARSHAL H.R.H. THE DUKE OF CONNAUGHT.

FIELD-MARSHAL H.R.H. THE DUKE OF CONNAUGHT,
K.G., K.T., K.P., G.C.B., G.C.S.I., G.C.M.G.,
G.C.I.E., G.C.V.O., G.B.E.,

Colonel-in-Chief, Royal Army Medical Corps.

THE death of Field Marshal the Duke of Connaught on January 16, 1942, deprives the Royal Army Medical Corps not only of a much valued friend but of a most distinguished Colonel-in-Chief whose kindly interest was always appreciated by every officer and man of the Royal Army Medical Corps.

E. M. REICHEL Born at Buckingham Palace, on May 1, 1850, Arthur William Patrick Albert, Duke of Connaught and Strathearn and Earl of Sussex, was the third and youngest son of Queen Victoria. The date of his birth was also the eighty-first birthday of the Duke of Wellington who became his godfather, a fact which may have marked him out for distinction in a military career. Gazetted on June 1, 1868, to the Royal Engineers, he transferred to the Royal Artillery and later to the 1st Battalion, The Rifle Brigade, with which he bore part in repelling the Fenian Raid in Canada in 1870. True to his idea of seeing the working of each arm of the Service from inside, he became a Major in the 7th Hussars in 1874, but afterwards rejoined his old regiment, The Rifle Brigade. On March 13, 1878, he married Princess Louise, the daughter of Prince Frederick Charles of Prussia, who was his constant and devoted companion for thirty-eight years. Her memory is perpetuated in the Louise Margaret Hospital at Aldershot which was called after her. He commanded the Guards' Brigade at the battle of Tel-el-Kabir in 1882 for which he was mentioned in despatches and received the C.B. In 1902, the Duke was created a Field Marshal. His period of command of the Bombay District from 1886 to 1890 and his holding of the appointment of Commander-in-Chief at Aldershot in 1903 showed him to possess the highest military capacity. He became Governor-General of Canada in 1911, a post which he held with conspicuous success until 1916. His friendship for the Royal Army Medical Corps was shown in many ways and, in particular, by his selection of Captain F. G. Brackenridge to be his surgeon during a sporting trip in East Africa in 1910 and his later choice of Captain E. Worthington in 1911 to accompany him to Canada in the same capacity. Many of our officers and other ranks will remember his kindly and efficient inspections and some will be able to recall more intimate occasions of contact and friendship. He did us the honour of becoming our Colonel-in-Chief in 1919 and we deplore in his death the loss of a great soldier and a true friend.

Authors are alone responsible for the statements
made and the opinions expressed in their papers.

Journal of the Royal Army Medical Corps.

Original Communications.

SHORTCOMINGS OF COMMERCIAL STEAM DISINFECTION APPARATUS.

BY LIEUTENANT-COLONEL A. G. GADD, A.M.I.MECH.E.,

Royal Engineers,

AND

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Royal Engineers.

(1) PRESENT PROCESSES.

STEAM disinfection by Field Units is normally carried out with "current steam" apparatus at, or slightly above, atmospheric pressure, using one of the Disinfectors Portable Field or an improvised substitute. Disinfection in hospitals, and sterilization, is usually done in commercial pattern apparatus working at 15 or 20 pounds pressure per square inch. Commercial current-steam disinfectors are also employed.

In all cases the apparatus is relied upon to give contact with the disinfecting steam throughout the "charge" of articles treated for the full period required for disinfection. As regards the Service apparatus, full care is taken, before adoption of the type, that such confidence is justified. Tests and theory agree, however, that all commercially designed plant has inherent failings which render its operation unreliable.

"High-pressure" disinfectors all work on the same principles. The charge is put into a "container" made of wire-mesh on a steel framework. For treatment the container, which is fitted with wheels, is run into a cylindrical or oval "chamber" which has a door at each end. The doors being

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closed on the loaded container a vacuum is created inside the chamber. When a sufficiently high vacuum exists the air outlet is closed and the steam inlet turned on. Steam is admitted until the pressure reaches that specified for the apparatus and is held at that pressure for the disinfecting period of ten to twenty minutes. The steam is then allowed to escape and hot air is passed through the chamber to dry the charge. After the specified period of drying the hot air is shut off, the exit door opened, and the container is run out for unloading.

Commercial current steam disinfectors have the same general construction as the high-pressure type but no vacuum is created prior to steam-admission. An exhaust vent in the bottom of the chamber is opened when steam admission begins and air is thus flushed out of the chamber. Steam is then passed through continuously, for say half an hour, after which drying follows as before.

(2) FAILURE OF VARIOUS COMMERCIAL DESIGNS.

(a) *Disinfector No. 1 (High Pressure)*.—15 lb. per sq. inch, portable, capacity between 50 and 60 cubic feet. Load scheduled in Appendix 15 of Army Manual of Hygiene 1934—50 to 60 blankets.

In January, 1941, a number of high-pressure disinfectors, adapted for field use, was offered for sale to War Department. One was ordered as a sample and went to the Army School of Hygiene for test and report. The tests were arranged and supervised by the staff of the School, as medical experts, and attended by one of the authors as engineer-inspection specialist. The tests were carried out with Army blankets in which temperature-indicator tubes were buried. Since the operating pressure was 15 lb. per sq. inch, the indicator tubes should have been such as would indicate the attainment of the temperature of steam at this pressure—namely 121° C. Such tubes were not available, however, and the 100° C. tubes made for testing the Service disinfectors had to be used instead. There is a negligible time-element in these tubes, which change colour almost immediately on subjection to a temperature of 100° C. The colour-change may begin, however, at a slightly lower temperature—say 94° C.—and must be complete to be satisfactory. Tubes remaining unchanged prove the maximum temperature reached in their locality to be well below 100° C.

The test load was 60 blankets, that is roughly one per cubic foot of chamber-volume, and was a normal full-load for the size of chamber and container. Out of ten indicator tubes used, five failed to change colour. A repeat test on the following day gave a similar result.

Following this failure, strenuous efforts were made to “turn” the tubes by doubling the time of subjection to pressure-steam, by raising the pressure to 20 lb. per sq. inch (126° C.), and by varying the method of loading the blankets. All the tests failed. The disinfector had been shown to be unreliable, even defining disinfection as the attainment of only 100° C. in an apparatus subjecting the charge to steam at a temperature of 26° C. higher.

These results engaged the serious attention of those witnessing them. The manufacturers concentrated on making the plant effective by experiments on a similar model at their works while the authors looked for, and found, the basic causes of failure and the means of correcting them. It was, of course, realized generally that the immediate cause was the presence of unwanted air.

At their works the makers tried various expedients—improving the ejector, repeating the air-evacuation, reducing the load—but these were unsuccessful or impracticable. The results threw suspicion on the effect of a baffle-plate intended to prevent hot drying air from impinging on the charge. This was reduced in area by nine-tenths and, simultaneously, the effect of flushing the air out by steam, instead of using the ejector, was tried. The combination gave satisfactory results with a reduced load of 46 blankets. The necessary parts for conversion of the disinfecter still lying at Aldershot were sent forward and fitted but a re-test after conversion was unsuccessful, one tube out of six remaining unchanged in the first trial, and two out of eight in the second. A visit was paid by the authors, who took with them various new parts to convert the plant to correct principles, which they had meanwhile deduced. On arrival, however, they found that the Army School of Hygiene had not been advised of the internal alterations necessary and, assuming this to be the reason, abandoned their project. As will be seen later, their proposals involved the use of a well-equipped workshop and moreover would have delayed acceptance of the disinfecter which was now urgently required for use. The staff of the Army School of Hygiene then decided to remove the baffle-plate entirely, after which the disinfecter gave good enough results to be put to use with a restriction placed upon the load. It must be remembered, however, that the indicator tubes were still of the 100° C. type though the pressure had been raised to 20 lb.

(b) *Decision to Test Other Designs.*—During this time a decision was taken to conduct a series of tests of different commercial designs purchased by the War Department, with Army School of Hygiene and Inspection Department, Engineer and Signals Stores co-operating therein. As far as possible new plant was tested, operated by the makers at their works with steam from a steam main, thus obtaining the most favourable working conditions for the plant. Army blankets, as being the most commonly treated articles, were to be used and the load was to be a reasonably full one—that is, a quantity within the capacity of the container to hold without heaping, such as the operator would normally load up. The loads were generally below those scheduled in Appendix 15 of Army Manual of Hygiene 1934.

(c) *Disinfecter No. 2 (High Pressure).*—15 lb. per sq. inch, stationary. Capacity between 60 and 70 cubic feet. Load scheduled by Appendix 15 of Manual, 60 blankets.

This was of different design from No. 1. It had just been installed in the Aldershot area and was tested by the Army School of Hygiene. The

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tests failed. With a load of 50 loose blankets, 2 tubes failed to change out of 12. Loading the same number of blankets in 5 rolls each of 10 blankets, 5 tubes remained unchanged out of 15.

(d) *Disinfector No. 3 (High Pressure)*.—15 lb. per sq. inch, stationary, capacity between 30 and 40 cubic feet. Scheduled load 30 blankets.

This was generally similar to Disinfector No. 1 but a stationary model. In three tests, with a load of 30 blankets in rolls of 10 blankets each, the tubes found unchanged numbered 9, 11 and 8 out of 11, 15 and 15 respectively. The disinfector was then altered in the same way as No. 1, after which it treated 30 loose blankets successfully.

(e) *Disinfector No. 4 (High Pressure)*.—20 lb. per square inch, stationary; capacity between 115 and 125 cubic feet. Scheduled load 120 blankets.

The above results apparently created some discussion in the disinfector world for the authors were then asked by the makers of yet another design to test their standard apparatus at their works. The request was at first declined, as there were no War Office orders open at the time with this firm, but was granted on being repeated and pressed a few days later. In the first test 47 tubes were used in a charge of 98 folded blankets and no fewer than 30 tubes remained unchanged. A repeat test with 60 loose blankets gave 9 tubes unchanged out of 26. A third test was made also with 60 loose blankets but with the evacuation process carried out twice over and the period of holding at disinfection pressure lengthened by 50 per cent. In this test, which took 127 minutes, all the 23 tubes used were changed, but the blankets were all rendered unserviceable and had to be "written off."

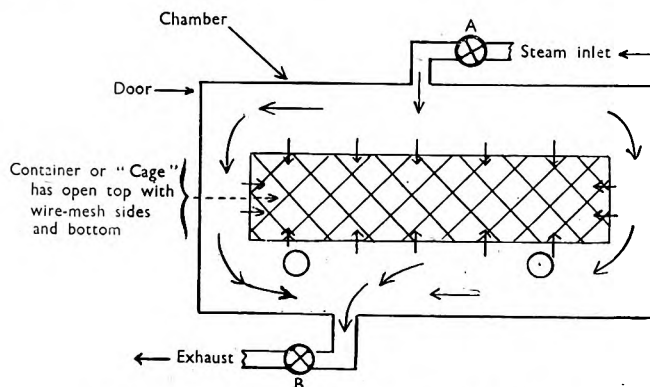
(f) *Disinfector No. 5 (Current Steam)*.—Pressure virtually atmospheric. Stationary, capacity between 55 and 65 cubic feet. Scheduled load, 50 blankets.

Two months later a current-steam disinfector ordered for a Reception Station came up for acceptance tests at the makers' works. With an easily permeable load of one flock mattress success was obtained but, with a load of 40 loose blankets, 6 tubes out of 18 failed to change colour. The makers thought they could correct matters and were given an opportunity to do so. They split the load into two by a horizontal grid half-way up but with 40 loose blankets 5 tubes out of 18 remained unaffected. The cold spots were concentrated around and above the exhaust vent. The only way to make this disinfector acceptable now appeared to be reconstruction to the authors' ideas, of which an explanation follows.

(3) REASONS FOR FAILURES (*see diagrams*).

It will be realized that any air remaining in the charge during the period of treatment will be a grave deterrent to proper sterilization or disinfection, firstly because air is an efficient heat-insulator and secondly because bacterial organisms have a much greater resistance to hot air than to steam. With all high-pressure steam disinfectors or sterilizers, air-extraction is carried out with a steam ejector in which steam at high velocity is directed through

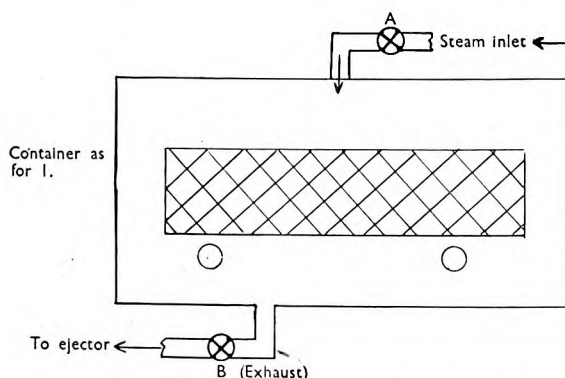
a nozzle past an orifice opening from the chamber containing the charge. The steam flow draws air from the chamber, creating a partial vacuum. The extent of the vacuum so formed depends on the efficiency of design and use of the ejector and may vary from about 16 inches of mercury up to 24 or 25 as a maximum. A complete vacuum, i.e. the extraction of all air, is represented by the barometric pressure—say 30 inches—and is unattainable.



I.—Current Steam Disinfector. Present design.

Arrows show steam flow.

Operation.—Cocks A and B both opened, steam is passed through continuously for disinfection, but finds easy passage to exhaust round sides and ends of container. No compulsory passage through charge in container.



II.—High Pressure Disinfector. Present design.

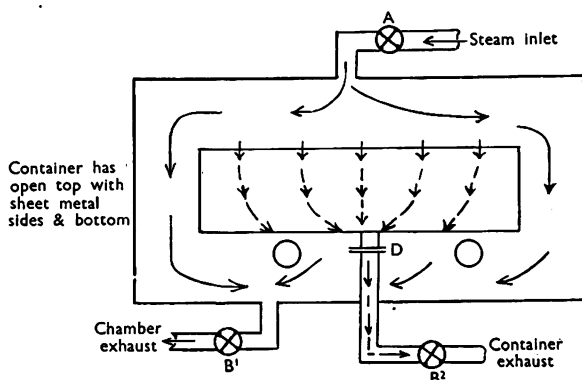
Operation.—(i) A, shut; B, opened. Some air extracted via B by ejector, leaving up to one-third remaining within chamber and charge. (ii) B, shut; A, opened. Steam admitted to fill chamber and build up pressure. Air and steam in unknown state of mixture fill chamber and charge. Steam penetrates charge from all sides without expelling air therefrom.

It is thus impossible to extract the whole of the air from chamber and charge. With a vacuum of 20 inches (an average figure in practice) and assuming constant temperature, about one-third of the original air-content remains. With a chamber of say 120 cubic foot capacity, the quantity of air retained is seen to be huge.

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When the vacuum is sealed and the steam admitted all this air is trapped. Exactly how it behaves is problematical. That which surrounds the charge will intermix readily with the incoming steam condensing some as it heats up; that which occupies the interstices of the charge may be forced inwards as the steam pressure, to which the charge is exposed on all sides, rises. The extent of admixture with steam of the contained air will be greatest at the surface of the charge and least towards the heart. Since air is heavier than steam, the areas where air is richest will be somewhat below the actual centre-line, and it is here that "cold spots" will be found.

The richer the air the cooler the mixture. With the customary rate of steam admission, therefore, the situation at the moment when the pressure has reached that specified (say 15 lb. per square inch) will be that there



III.—Both Types as Converted.

D is automatic valve or coupling.

Operation.—(i) A, B¹, B², all open, incoming steam rapidly displaces "free" air from chamber via B¹, during which time partial penetration of charge occurs from top only, as shown by arrows. (ii) B¹ is closed as soon as free issue of steam from it shows displacement of "free" air to be complete. Incoming steam can now only escape via B², i.e. downwards through charge, completing penetration and air expulsion as shown by arrows. Penetration complete as soon as steam issues full bore from B². (iii) Current steam type. Steam passage from A to B² continued for as long as is considered necessary for steam at 100° C. to kill bacteria. High pressure type. Valve B² shut and steam admission continued until required pressure is built up. Pressure then held as long as desired.

exists in the chamber a temperature gradually diminishing from a maximum somewhere near that of saturated steam (121° C.) to a minimum which may be little above that of the ambient atmosphere. It is misleading to say that the "disinfecting period has begun." The disinfecting temperature within the charge is a long way from being reached. More steam has to penetrate the outer layers of the charge until it is condensed in giving up its latent heat to warm up the air and the material. Still more must follow it, reaching a little further, and so on until the heart is reached and then sufficiently heated. How long it will take before the air-steam mixture in the heart reaches even 100° C. cannot be stated and there is no visual or other sign to indicate completion.

In the current-steam commercial designs a somewhat similar result is obtained in a different way. The chamber is not sealed so no air is trapped. The "free" air is rapidly displaced from the chamber altogether by the incoming steam. So far, so good. Now the steam has to remove, or heat up, the air contained in the charge. Finding an easy path through the chamber from inlet to exhaust around the sides and ends of the container it naturally takes it, avoiding the charge itself, and we are back to the same gradual penetration and intermixing as before. Moreover there is now no "spare heat." The steam is at virtually 100°C . itself whereas its temperature is 121° or 126°C . in the high-pressure types. An air-steam mixture at a temperature 20° below that of the pure steam will still suffice in the high-pressure apparatus—or so we hope. With current-steam it is virtually useless, regarded as disinfection and not mere disinfestation.

(4) METHOD OF CORRECTION.

It will be as well to compare the machines so far discussed with any of the Service Disinfectors—for example the Disinfector Portable Field No. 3—particularly since the correction of the failings follows the design and operation of this apparatus. The Disinfector Portable Field *does* achieve the full disinfecting temperature by contact with steam in every part of the charge—in one of very many tests, carried out without a single failure, over 150 indicator tubes were used in a full charge of 32 blankets, i.e. 256 thicknesses. It does this with a load of three blankets per cubic foot of chamber compared with one, or under one, ineffectively treated in commercial models and in less than half the time.

These results are due to the rapidity, reliability and completeness of air-displacement, which is achieved as follows: The charge is held in an impermeable sheet-steel open-topped container which it closely fits. Steam is admitted to the top of the charge only and the exhaust opening is arranged so that steam can only escape to atmosphere by passing right through the charge itself in a downward direction. The difference of density between steam and air, and the pressure built up above the charge, combine to urge the air gently through the charge and out of the exhaust at the bottom. No air is trapped and there is an almost negligible amount of intermixing. The uninterrupted emission of pure steam from the exhaust is a visual indication that the expulsion of air is as nearly complete and perfect as can be and a few minutes of steam passage is enough to ensure that the charge is wholly filled with pure steam at atmospheric pressure. Any higher temperature could now be reached merely by closing the exhaust and continuing steam admission until the pressure equivalent of the desired temperature was attained. For now we are dealing with pure steam, not with air-steam mixtures of varying and unknown composition, while, since the container is steam jacketed, there is no heat-loss through the walls.

All that is necessary in commercial designs, therefore, is to apply these principles of construction. The container, instead of being made of wire-

mesh, will have sheet-metal sides and bottom with an open top. From an opening in the container bottom an exhaust-pipe will be led through the chamber-wall to atmosphere. The container will be so loaded that no gaps or easy paths are left down which steam will flow in preference to passing through the mass of the charge. There are other details to attend to—for example the fitting of a cock to the container exhaust-pipe outside the apparatus, to be closed for building up pressure, and the provision of a coupling to the container-exhaust *inside* the chamber, capable of being broken or made from either end of the chamber, to enable the container to be run in or out. But these offer no constructional difficulty. The main principle is merely “downward displacement” which has been the feature of all Service disinfectors for many years.

(5) TESTS OF RECONSTRUCTED DISINFECTORS.

(a) *Disinfector No. 5.*—With the approval of the Directorate of Scientific Research full details of conversion of Disinfector No. 5 were given to the manufacturers of this current-steam plant by the authors and the work was at once put in hand. After some delay owing to difficulty in obtaining certain materials the altered disinfector was ready for test by July 21. The disinfector-container had been provided with an automatically operating exhaust coupling and the whole plant was a workable outfit ready for immediate installation. The shape of the container had not been altered and was normal for a cylindrical chamber.

Instant success was achieved with a remarkable shortening of the total time taken for each cycle. Forty loose blankets were effectively disinfected in eleven minutes and forty folded blankets in thirteen minutes. After adjustment of the automatic valves the time to disinfect 40 folded blankets was reduced to eight-and-a-half minutes from closing the entrance door of the chamber to opening up for unloading. Remembering that the indicator tubes required the full saturated steam temperature of 100° C. to liquefy them, it will be realized how rapidly and thoroughly every vestige of air had been expelled and replaced by steam. The improved disinfector was at once accepted and its despatch to site for installation was ordered.

After installation, the authors attended its first putting to service, taking indicator tubes. A load of 60 blankets (20 per cent higher than the scheduled figure) was laid down as the standard maximum. The piping layout, having been designed for the original model, was unfavourable but its correction had to be deferred and, in any case, its effect was only to lengthen the operating cycle. The first operation was allowed to be carried out by the R.A.M.C. Corporal in charge, without fully instructing him, so as to prove to him the necessity for the simple precautions to be taken. Before the disinfector was unloaded, he was told that the tubes, which had been evenly distributed throughout the charge of 60 blankets, would reveal failure. In fact 5 tubes out of 19 failed to respond, the unchanged tubes being found in the precise places which had been forecast. Next, the correct

handling of the plant was demonstrated with satisfactory results. Check tests were carried out on four occasions in the following weeks—once to verify that the operator was still working correctly, once to observe the effect of the altered piping layout and twice to carry out overload tests. On October 1, 1941, a load of 6 rolls of 10 blankets each, with 7 extra blankets added, was tried using three tubes in the middle of each roll. This is an unfavourable way of preparing blankets and had proved incapable of giving 100° C. disinfection in any high-pressure apparatus so tested, even when in Disinfector No. 1 a pressure of 20 lb. per sq. inch had been maintained for forty-five minutes. The second overload test was made on November 14, when no fewer than 90 folded blankets were crowded into the heaped container with forty tubes evenly distributed throughout the charge. Both of these severe tests were passed by what the authors hold to be the first commercial steam disinfector ever installed which can be relied upon to do its job.

(b) *Disinfector No. 6 (High Pressure)*.—15 lb. per sq. inch, 120 cubic foot chamber, 11 cubic foot container. Special model.

Meanwhile the manufacturers of Disinfector No. 4 had independently constructed a high-pressure disinfector working on the same downward displacement principles. They demonstrated this plant to us on July 18. It was of an experimental type, consisting of a normal 120 cubic-foot cylindrical chamber in which had been fixed a container which was an exact duplicate of that of the Disinfector Portable Field No. 3. This container is rectangular, of capacity only 11½ cubic feet, and looked odd in such surroundings. It was fitted with an exhaust of screwed steel pipe with no coupling so that, although there was no chance of steam leaks, there was equally no possibility of withdrawing the container from the chamber. The container was loaded (with difficulty owing to the heat inside the steam-jacketed chamber) with 32 blankets folded as prescribed for the Disinfector Portable Field No. 3. Buried in the charge were indicator tubes of a different type, of which a description must be given. These are glass tubes containing a red liquid. On being heated, this liquid changes colour gradually through amber and olive to bright green and the temperature to which it is subjected is indicated by the time taken to effect the complete change—or, alternatively, the extent of the colour change in a given period of time. The tubes are designed to change from red to green in a temperature of 115° C. (equal to 10 lb. steam pressure) held for twenty-five minutes but will do so at higher temperatures for shorter periods or lower temperatures for longer periods. The heat effect is cumulative—that is to say, a tube partly changed by subjection to 115° C. for ten minutes will, after cooling, complete its colour-change on being reheated to the same temperature for the other fifteen minutes. Similarly a tube heated at 100° C. for five minutes will afterwards require less than twenty-five minutes at 115° C. to complete its change, while a tube not completely “turned” after twenty-five minutes’ subjection to an unknown test temperature may finish its conversion to

green if afterwards subjected to a lower temperature for a few extra minutes. All these factors, though rather involved, have a bearing on tests conducted with this type of control.

The test of the "mock-up" high-pressure apparatus was entirely successful. Since the load consisted of 32 blankets only this may at first sight be unimpressive, but that is only due to the choice of a container of unsuitable size and shape for the chamber. Even so, the load amounted to a solid wad of 256 thicknesses of blankets and, when it is remembered that the test was now 115° C. held for twenty-five minutes, not 100° C. for a few seconds, the immense improvement in air-expulsion and steam-penetration is manifest.

(c) *Disinfector No. 7.*—120 cubic foot capacity, 15 lb. per sq. inch, scheduled load 120 blankets.

In October, 1941, these manufacturers produced their first commercial model—a 120 cubic foot disinfector, to a War Department order, which was operated by them at their works. The container was found still to follow the Disinfector Portable Field No. 3 design, being a long rectangular sheet metal box divided by removable vertical slides into four compartments each similar to the Disinfector Portable Field No. 3 container. The slides would be taken out to accommodate mattresses. Sixteen 115° C. tubes were used in a charge of 98 folded blankets. No more blankets were available.

The design and operation revealed an incomplete understanding of the principles involved and the authors were not altogether surprised when one of the tubes failed to complete its colour-change. The test conditions were not unfavourable to the apparatus. The control tubes were sensitive to a temperature of 6° C. below that of the steam while the effect on them of their subjection to steam at varying pressures from atmospheric to 15 lb. during the periods of air-expulsion, building-up pressure, and releasing pressure must be taken into account, as well as the twenty-five minutes of actual disinfection. It is clear that the "unturned" tube shows that this particular disinfector still falls short. It can, however, be easily converted to a completely reliable apparatus by the authors and probably will be.

(6) DISCUSSION OF TESTS.

Lack of space prevents the publication of full details of all the tests. These have been tabulated with remarks and a copy can be obtained by any interested reader on application to either of the authors at Shepherd's Green, Chislehurst, Kent (Telephone: Chislehurst 1953). The extracts already given will, it is hoped, suffice for this discussion. The tests show the inability of apparatus of present design to disinfect with certainty a normal load of blankets in the specified times. They indicate also that doubtful results may be obtained even with much-reduced charges.

(a) *Inadequate Testing.*—This situation has arisen, in our opinion, through the use of too few "tell-tales" in the customary disinfector tests. Except in the Service, tests are customarily made with bacterial tubes, using only a few at a time. Such tests may easily fail to find the "cold

spots" in a bulky charge. In the Service this has always been realized and Service-designed apparatus has always been subjected to tests even more rigorous than those now discussed. In most Service tests of disinfectors, however, the temperature-indicating tube is used for convenience instead of cultures.

(b) *Characteristics of Temperature-Indicating Tubes.*—The temperature-indicating tube has great advantages over the use of cultures. It is cheap, small, easy to handle, visibly responsive, and can be used in abundance to give a true picture of what actually happens. But its use outside Service circles seems to be almost non-existent. None of the manufacturers concerned in these tests had ever used them—most, if not all, had never seen one. Perhaps, on that account, some reassurance regarding its accuracy is desirable. Most of the 100° C. tubes used in these tests were made either by the Army School of Hygiene or by the Royal Army Medical College and the others were specially developed for us by the makers of the 115° C. tubes. A percentage was checked in boiling water or atmospheric steam while those which failed to react in the disinfectant tests were usually either put into boiling water or put back in the disinfectant *on top* of the load in the next test. In no case did the tubes fail to respond.

Since, however, the Army School of Hygiene and Royal Army Medical College 100° C. tubes start to colour a few degrees *below* 100° C. they are a better indication of *failure* to disinfect (when they remain unaffected) than as positive proof of disinfection. For the latter purpose, complete liquefaction is necessary, and owing to re-cooling this requires speed as well as judgment by the observer.

The 115° C. tubes could not be so simply checked owing to the heat-accumulation effect. Of these, therefore, a proportion was tested in thermostatically-controlled muffles in the Inspection Department Engineer and Signals Stores, a further proportion being similarly tested in the laboratories of a well-known instrument firm. Time-temperature curves were plotted which agreed well with each other while the results at 115° C. were close to the twenty-five minutes specified by the makers. The reliability of both types of tube was therefore adequately demonstrated.

(c) *Lessons of the Tests.*

- (i) *Irregularity of Results.*—Failure to "turn" indicator tubes was found to occur in apparently different places and to a different extent when trying to repeat a test in any particular plant. This may be partly due to the tubes not being in exactly the same position but is more likely to be caused by slight variations in the packing of the blankets such as will occur in use.

There is apt, however, to be a weak feature in any one design causing a persistent "cold spot"—for example the baffle plate in Disinfectant No. 1 and the exhaust-hole in Disinfectant No. 5 before its conversion. So that not only is an adequate margin of safety to cover variations in packing neces-

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sary in the operation of the plant but special study is desirable of the weaknesses of any particular installation.

- (ii) *Maximum Load*.—The loads given in Appendix 15 of the Army Manual of Hygiene and Sanitation, 1934, are far too great. It is almost certainly fatal to disinfection to load up the container level with blankets to the top.
 - (iii) *Method of Packing*.—Blankets should be loaded loose. Rolls of ten should be forbidden.
 - (iv) *Permeability*.—It is the compactness and depth of a charge, i.e. its nature and the distance to its heart, which affect results most. The bigger the container the bulkier is a full load and the worse are the results. Refer para. (2) (e) above. The load of 98 blankets was well below that given in Appendix 15 of the Manual.
 - (v) *How to Test*.—In an investigation a multiplicity of tell-tales should be used, at first, say 30, fewer as the story unfolds. Finally, as a check on measures taken, about 30 again, evenly distributed in the mass.
 - (vi) *Further Tests*.—There is a case for more thorough and scientific investigation which should be extended to steam sterilizers also.
- (d) *Improvement of Existing Plant*.
- (i) *Reconstruction*.—We advise against Medical Officers attempting (unless experimentally) the reconstruction of their apparatus to the principles expounded in paragraph (4). Each design of plant needs special treatment with a fuller understanding of the process than is there explained. The construction is the subject of patent applications though the State will no doubt have "free user" rights.
 - (ii) *Improvement without Reconstruction*.—There is some possibility of improvement by variation of the technique. Displacing the "free" air by steam, instead of creating a vacuum, may or may not bring any definite gain. But the effect of using *both* methods—that is, first flushing out the free air by steam and then "drawing a vacuum" in the steam-filled chamber is worth trial. So also is the use of a wire-mesh "core," either cylindrical or of the same cross-section as the container, around which to pack the charge. We suggest loading say one-quarter of the blankets first, then laying the core on them, then loading the remaining blankets around the sides and over the top of the core. The objects are to increase the area of surface open to steam penetration and to reduce the thickness of the charge. The core must extend from end to end of container, of course, and its ends be left unobstructed. An automatic limitation of load will be obtained.

Splitting the charge horizontally by a mattress-like wire grid may also be worth further trial.

In general, however, the weaknesses of the particular plant should be studied first.

(e) *Immediate Action Advisable.*

We believe that meanwhile it is necessary to impose drastic limitations on the number of blankets loaded. Disinfector No. 1 was restricted to 30 blankets, i.e. one per 2 cubic feet of chamber-volume, and we believe this to be the limit of safety for 60-foot disinfectors. Twenty is our idea of the limit for disinfectors of 30 to 40 cubic foot capacity and 40 for those of 120 cubic feet. The proportion of blankets to volume should diminish with the increase in volume to avoid increasing the depth of the charge appreciably.

With the above charges, a minimum of twenty minutes at full pressure should be given and we prefer thirty. We assume that a minimum of 20 inches vacuum is obtained. Forty minutes "contact" in a current-steam disinfector should be given.

The output of the plant, which is already costly, clumsy, uneconomical and slow, will be made even worse. About 200 blankets a day will be the output of a 60-foot disinfector. This is one hour's output of the Disinfector Portable Field No. 3, or eighty minutes with the Disinfector Portable Field No. 1. It is only four hours' output even, of the little Disinfector Portable Field No. 2 which a couple of men can carry about.

(7) DRYING BLANKETS.

During these tests some interesting points arose in connexion with the drying operation. Designs were seen in which the drying air is taken from inside the "dirty" room where the loading is done—with Disinfector No. 2 the air intake was actually only about 18 inches from the floor where lay dust and fluff from "dirty" blankets.

The drying air is heated to an unknown temperature, probably well below that which is necessary to sterilize it. A thermometer in the air-outlet from the heater might give surprising readings.

Finally, to establish a conviction that hot-air drying was ineffective, we weighed a loaded container before treatment, after disinfection but before drying, after drying, and after vigorous shaking. The results were as follows:

Number of blankets	..	46.		
Weight of blankets and container before disinfection	..	298 lb.		
" " " " " " " " " "	..	309 lb.	Gain 11 lb.	
" " " " " " " " " "	..	306½ lb.	Loss 2½ lb.	
" " " " " " " " " "	..	301 lb.	Loss 5½ lb.	
Final gain in weight 301 - 298 = 3 lb.				

In steaming the gain was roughly 4 ounces per blanket. Half an hour's drying removed an average of less than 1 ounce. Of the balance, two ounces were removed by shaking, leaving a final gain of one ounce per blanket. The fact is that hot-air drying affects the outside of the charge only, the heart remaining as full of steam as ever. Prompt and vigorous shaking is necessary in any case. It is quite sufficient by itself.

AN INVESTIGATION OF NIGHT VISION AMONG PERSONNEL OF AN A.A. UNIT.

BY CAPTAIN BRIAN ST. J. STEADMAN,
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It is known that the quality of night vision varies considerably in individuals, who frequently have erroneous ideas of their powers in this respect, because of difficulty in comparing this quality. It was found that certain personnel of Searchlight Units known as "spotters" make operational use of their night vision. Their duties consist of searching the night sky with binoculars for hostile aircraft in and around the distal end of the searchlight beam.

The night vision of the "Spotters" of a Searchlight Regiment was investigated with the object of comparing the quality and eliminating those in whom it was deficient in an endeavour to increase the operational efficiency of searchlight work. Firstly, the physiology of vision will be discussed briefly.

PHYSIOLOGY.

The duplicity theory of vision as expounded by v. Kries states that two types of activity exist in the retina. There is a photopic mechanism mediated by the cone cells, which concerns itself with form vision and colour vision, and has a relatively high threshold stimulus intensity, which is typically evident in the light adapted eye. There is also a scotopic mechanism, mediated by the rod cells, which is concerned with the appreciation of light and movement, and is achromatic, working with a low threshold stimulus intensity and, therefore, being particularly evident in conditions of dark adaptation.

The photochemical theory of vision which has more recently been advanced, particularly by Hecht, states that the sensitivity of the retina at any stage of adaptation is determined by the concentration of photo-receptor substance in the cone and rod cells—visual violet, or iodopsin, in the cones and visual purple, or rhodopsin, in the rods. During an exposure to light these substances are bleached and both the cone and rod thresholds are elevated. As they regenerate in the dark retinal sensitivity increases and the familiar dark adaptation curve may be obtained.

The rods and cones lie in the layer next to the pigment cells, which form the outer layer of the retina. Both types of cells are distributed all over the retina except at the fovea centralis, which is covered almost entirely by cones, and at the point of entry of the optic nerve, which is devoid of either. The rods outnumber the cones.

Visual purple was found in the rods by Kuhne (1868) and has rarely been demonstrated in the human eye owing to difficulty in manipulation and

the impossibility of perceiving it with the ophthalmoscope because of its colour. It is a heavy protein molecule with vitamin A attached, and is broken down by light liberating a new caretenoid, retinene (which gives the visual yellow stage). The reaction is reversible. Retinene may be converted further to vitamin A but its regeneration to visual purple will then take longer.

Visual violet was demonstrated in the cones in chickens by Wald (1937) and in frogs by Chase (1938), and is probably three separate substances with slightly different spectral sensitivities. It is even more difficult to manipulate than visual purple.

DARK ADAPTATION.

The increase in sensitivity of the retina, caused by the regeneration of the photo-receptor substance in the cones and rods is known as dark-adaptation. It occurs rapidly in the first five to eight minutes of darkness or semi-darkness and is due to regeneration of visual violet in the cones. This is known as foveal dark adaptation and the retinal sensitivity is increased ten to twenty times. After a slight lag retinal sensitivity continues to increase rapidly for a further thirty to forty minutes after which the increase is more gradual. This is due to regeneration of visual purple in the rods. At the end of one hour the sensitivity of the retina may be increased to anything between 50,000 and 100,000 times. It may continue to increase for a longer time, and the sensitivity may be perhaps as much as five times as high at twenty-four hours as at one hour. For all practical purposes, however, the eye is considered to be fully dark-adapted at the end of one hour.

The area of sensitivity of the dark-adapted retina increases rapidly to five degrees eccentric from the fovea. It continues to increase more slowly, reaching a maximum at twenty degrees, and diminishes towards the periphery.

In investigating night vision (i.e. the sensitivity of the dark-adapted retina) we are concerned mainly with rod adaptation and visual purple.

Whether the rod mechanism is being used can be tested by looking directly at a star and then noting if it appears brighter when the line of vision is deviated by 6° or more. In the same way, after looking directly at a constellation such as Pleiades, one becomes aware of the presence of more stars if the line of vision be deviated slightly.

The fact that the periphery of the retina is more sensitive when dark-adapted than the fovea accounts for the ease with which moving objects are seen in semi-darkness compared with stationary ones.

These latter points are brought out in the training of the A.A. personnel under investigation and are generally known by them.

Dilatation of the pupil causes a direct fall in the achromatic threshold and mydriatics have been used with good effect in certain cases to aid the night vision of night pilots in the R.A.F. Paredrine hydrobromide (Menley

and James), the effects of which only last four hours, has less disadvantages than other mydriatics for this purpose, but, of course, can only be given under medical supervision which makes its use impractical on isolated A.A. sites.

No steps are taken to dark-adapt the eyes of "spotters" before they "take post" from lighted huts, and in short raids hostile aircraft must be long out of range before their eyes are adapted to their surroundings. It is of some importance that the eyes of all personnel of A.A. Units who make operational use of their night vision should be dark-adapted before "taking post," and this can be brought about by the wearing of dark goggles from at least forty-five minutes before black-out and not exposing the eyes to light again until dawn. On leaving the hut to go to their positions the goggles would be removed and replaced before re-entering the lighted hut. The men's eyes would thus be fully dark-adapted during the whole night. Suitable goggles can be made cheaply and should transmit about 5 per cent of light. No light should be allowed to enter at the periphery which must fit closely. Some form of ventilation should be provided, such as rubber sponge, and anti-dim compound is of value. Night-adaptation goggles of this type are in general use in the R.A.F. and are made by Messrs. J. and R. Flemming Ltd. After wearing these goggles for a few minutes games such as billiards and darts can be played but reading is difficult unless the light is strong. However, the wearer can carry on a reasonably social existence, which would be impossible if his eyes were dark-adapted in complete darkness. The spotter's present operational position is situated between 200 and 300 yards from the projector and must be adequately screened from ground glare and the source of light which would tend to diminish dark-adaptation. The distance between the spotter and the beam itself is thought to be sufficient to avoid interference with dark adaptation.

It is known that in Germany night pilots have been kept in total darkness for from twelve to twenty-four hours before flying in order to dark-adapt their eyes, but it is considered that this method causes depression and would adversely affect morale.

The only other member of a searchlight detachment who makes operational use of his night vision is the man on the Mark 9 Sound Locator, known as No. 6, but his maximum distance from the source of light is 75 yards and adequate screening therefrom is not possible without reducing his field of vision.

METHOD OF TESTING NIGHT VISION.

Most apparatus for testing the degree of sensitivity of the dark-adapted retina depend on a ray of light of variable low luminosity but the quality which is now required and which is under investigation is the ability to perceive the slight difference in contrast between a dark moving object and a background of low luminosity, i.e. aircraft flying at night. Exact definition of form is not of great importance as the variety of objects which can travel through the sky is obviously limited.

The Livingston Rotating Hexagon is in general use in the R.A.F. for testing and comparing the night vision of pilots, prospective pilots, and air crews and was constructed by the Consultant in Ophthalmology with this object in view.

The apparatus, as its name implies, consists of a hexagon which can rotate and which is illuminated from within by light of extremely low, but variable, intensity. Six men can be tested at a time. Their eyes are dark-adapted by the wearing of dark goggles for thirty minutes before the test. They are then brought into the room and seated three feet from the apparatus, each opposite one of its facets. The light of the room is extinguished and the goggles removed. The men are kept for fifteen minutes in complete darkness whilst the test is explained.

The apparatus is then switched on, having an illumination in the first instance of 1/850 foot candles, and one minute is given to recognize and write down two objects or signs which are superimposed on each of the dimly lit translucent facets of the hexagon. With the same illumination six letters (Snellen's Type 6 metre letters) must be recognized and written down within one minute. Some of the letters are reversed, inverted or lying sideways.

This test is repeated three times with increasing degrees of illumination but with variation of the objects and letters. Each test is marked out of eight, each object or letter counting one mark, making a total of thirty-two.

The results are divided into the following groups :

Exceptional	32-29
Above average	28-20
Average	19- 9
Below average	8- 3
Poor	2- 0

One hundred and fifty-one spotters of the A.A. Unit were tested in this way. The men came from three batteries and the percentage in each group in comparison with 2,000 R.A.F. personnel is shown in the table below.

Fifteen officers were tested and their results are also shown in the table. Of these a large proportion are in the upper groups but the number tested was small.

	"A" Bty.	"B" Bty.	"C" Bty.	Total	Officers	R.A.F.
Number tested ..	48	56	47	151	15	2,000
Exceptional ..	4.2%	0.0%	0.0%	1.4%	20.0%	3.5%
Above average ..	29.2%	14.3%	11.1%	18.2%	26.7%	32.8%
Average ..	41.7%	50.0%	55.6%	49.1%	53.3%	49.6%
Below average ..	16.6%	30.4%	22.2%	23.1%	0.0%	13.1%
Poor ..	8.3%	5.3%	11.1%	8.2%	0.0%	1.0%
Average marks scored (out of 32)	15.6	11.3	11.9	12.9	19.6	—

The A.A. results compared with the R.A.F. are poor and the problem of the reason for this arises. In order to elucidate the problem the ætiology of the condition known as night blindness must be understood.

ÆTIOLOGY OF NIGHT BLINDNESS.

The clinical picture of night blindness presents characteristic features of an impairment or absence of the rod mechanism. The generally accepted ætiology of the condition is that it is due to : (1) Structural deficiency of the rods ; (2) deficiency of the visual purple ; (3) functional causes.

Structural deficiency of the rods occurs in the congenital types and in those cases due to gross pathological changes, and the condition is permanent.

The second group occurs under conditions of malnutrition associated with a deficiency in vitamin A and the prognosis is consequently good.

It must be borne in mind that a number of cases have been reported wherein no pathological changes or nutritional disturbances were found, and these were associated with neurotic or other functional symptoms, and were typified by the "shell shocked" soldier of the last war. It was for this reason that night blindness was not discussed with the men taking part in this investigation, but the term night vision, with qualifications, was invariably used.

GENERAL.

The results of the test on the Livingston Hexagon indicated an impairment of night vision in a number of cases compared with the R.A.F. results, rather than its failure. This impairment is unlikely to be due to gross pathological changes in the retina in such a large number of cases although the congenital factor may be present.

The Livingston Hexagon test is extremely difficult and intelligence definitely plays a part in the results. The fact that R.A.F. flying personnel are selected men whilst A.A. Troops are not, undoubtedly has some bearing on the matter. The A.A. men under investigation require no technical skill or special knowledge and in these days of mechanized soldiering the men in a detachment who lack qualifications tend to gravitate towards the spotter's chair. These men are frequently not the most intelligent.

The prospective pilot, too, is endeavouring to qualify for the job he has long desired to do but none of boyhood's romantic dreams are fired by the desire to become a "spotter."

The age-group of the 151 men under investigation was from 19 to 35 years with an average age of 25·3. The average age of the men in each group of the Livingston test was between 24·3 to 25·5 except for the exceptional group which only two men reached. The ages of the officers tested varied from 26 to 48 with an average of 33·3.

The occupations of the men were legion and did not appear to have any bearing on the results. The vast majority were townsmen who have been employed on A.A. work for between eleven months and two years.

VITAMIN A DEFICIENCY.

There is also the question of vitamin A deficiency. Vitamin A is fat soluble and is found in most green vegetables, carrots, egg yolk, dairy produce and

meat. It is stored in the liver (of animals, birds and fishes) which is therefore the most fertile source of supply.

The fact that night blindness could be cured by liver was known to the Egyptians 1,500 years B.C.

For this condition Hippocrates, 460 B.C., advised taking, once or twice, as big an ox liver as possible, raw, and dipped in honey!

Its cure by eating the fresh liver of seagulls or fish was widely practised in the Middle Ages. Epidemics of night blindness have occurred in famines in Russia and Austria and during the last war among troops living under conditions in which feeding fell below standard.

In chronic cases other degenerative changes in the eye occur (i.e. xerosis, epithelialifitis or keratomalacia).

Aykroyd describes cases occurring among the fisher folk of Newfoundland. For a considerable part of the year these people are completely isolated from the outside world. They live on a diet of white bread, molasses, fresh cod muscle, salt meat, beans, peas and some potatoes and are exposed to bright sunlight. No milk, butter, eggs, green vegetable or carrots are available. All cod-liver oil is exported but the fishermen prefer to cure the condition by eating a few meals of seagulls' liver, cooked or raw. Recovery usually occurs within two or three days.

Aykroyd found that all cases of night blindness were cured by vitamin A.

The rapidity with which the threshold of dark-adaptation rises during a diet deficient in vitamin A is an index of the body's vitamin A reserve which varies. Hecht and Mandelbaum carried out experiments on seventeen cases. Fourteen showed an immediate rise in the threshold of dark-adaptation when receiving a diet devoid of vitamin A. The remaining three cases took 22, 55 and 60 days respectively, to show a rise. A measurable response was elicited shortly after doses of vitamin A were given but the threshold rose immediately vitamin A was again withdrawn. Single doses of vitamin A had no effect. Vitamin A was administered for weeks, and in some cases months, before the threshold fell to normal again.

It is generally accepted that night vision is not improved by the addition of vitamin A to a diet that already contains sufficient, but improvement only occurs if the diet is lacking in the vitamin.

The men under investigation live on isolated sites which causes a certain amount of delay in the delivery of rations. Two batteries (333 and 334) are on the system known as "centralized" cooking which means that the food is cooked at Battery Headquarters one day, sent out to site and heated up the next, i.e. twice cooked. In addition there is a certain shortage of dairy products, etc. All these factors may play a part in reducing the vitamin A content of the diet. As a matter of interest the Battery that obtained the worst results in the Livingston Test was not on centralized cooking.

It was decided to give vitamin A to 50 per cent of the men of each battery who were tested on the hexagon and then to re-test all the men.

Vitamin A in the form of Adexolin Capsules (Glaxo Laboratories Ltd.) was

given in doses of 12,000 international units daily for the first week, and the dose was increased by 6,000 units daily per week until the third week, at the end of which the men were re-tested. If there was an interval of a day or two between the end of the third week and the re-test the men continued to take 24,000 international units of vitamin A daily up to, and including, the morning of the test. Of those originally tested 134 were re-tested, 68 having had Adexolin, and 66 acting as control.

The results of the two tests are compared in the tables below:

VITAMIN A (68)				CONTROL (66)	
		Before vitamin A	After vitamin A	1st Test	2nd Test
		1st Test	2nd Test	1st Test	2nd Test
Exceptional	..	1.5%	10.3%	1.5%	7.6%
Above average	..	16.2%	30.9%	21.2%	39.4%
Average	..	51.5%	45.6%	46.9%	34.8%
Below average	..	20.6%	11.7%	25.8%	18.2%
Poor	..	10.3%	1.5%	4.6%	0.0%
		17.7% } 41.2%		22.7% } 47.0%	
		30.9% } 13.2%		30.4% } 18.2%	

DIFFERENCE IN MARKS BETWEEN 1ST AND 2ND TESTS.

Marks	Vit. A		Control
+ (15 +)	..	3	2
+ (10 to 15)	..	11	13
+ (5 to 9)	..	19	16
+ (1 to 4)	..	20	14
0	..	8	1
- (1 to 4)	..	5	14
- (5 to 9)	..	2	6
- (10 to 15)	..	0	0
- (15 +)	..	0	0
		33	31
		33	29
		2	6

AVERAGE MARKS.

AVERAGE MARKS.								
Vitamin A					Control			
Bty.	(No.)	1st Test	2nd Test	Av. Inc.	(No.)	1st Test	2nd Test	Av. Inc.
332	(22)	12.6	16.9	4.3	(20)	11.1	14.3	3.2
333	(22)	13.6	17.6	4.0	(22)	16.9	19.7	2.8
333	(24)	12.3	18.7	6.4	(24)	12.4	18.7	6.3
Total	(68)	12.9	18.0	5.1	(66)	13.5	17.7	4.2

The improvement shown by those who took vitamin A was only slightly greater than that shown by the control. The diet of the men taking part in this test is therefore considered to contain sufficient vitamin A.

If the results of the second test are added together the comparison with the results of the first test and the R.A.F. results is of interest.

		1st Test (134)	2nd Test (134)	R.A.F. Test (2,000)
Exceptional	..	1.5%	8.9%	3.5%
Above average	..	18.7%	35.1%	32.8%
Average	..	49.2%	40.3%	49.6%
Below average	..	23.1%	15.0%	13.1%
Poor	..	7.5%	0.7%	1.0%
Average Marks		13.1%	17.7	

The results of the second test approximate more closely to the R.A.F. results, which are first test results. This may possibly be due to the A.A. troops being mentally slower than those selected as prospective pilots and air crews. An improvement is usual in the second test but it is not so great as the improvement shown in the table above.

VISUAL ACUITY.

Twenty-two¹ of those tested twice had a visual acuity of less than $\frac{5}{8}$ in one eye or both. This twenty-two included six men who had a visual acuity of $\frac{5}{8}$ in one eye and $\frac{5}{8}$ in the other and under A.C.I. 1428 of 1940 are in Visual Standard I. A comparison between the results with and without these twenty-two in both tests are tabulated below :

1ST TEST.			
	All Spotters (134)	V.A. less than $\frac{5}{8}$ $\frac{5}{8}$ (22)	V.A. $\frac{5}{8}$ $\frac{5}{8}$ or better (112)
Exceptional ..	1.5%	0.0%	1.8%
Above average	18.7%	0.0%	22.3%
Average ..	49.2%	*27.3%	33.6%
Below average	23.1%	40.9%	19.6%
Poor	7.5%	31.8%	2.7%
	20.2%	0.0%	24.1%
		72.7%	22.3%
2ND TEST.			
Exceptional ..	8.9%	0.0%	10.7%
Above average	35.1%	9.1%	40.2%
Average ..	40.3%	59.1%	36.6%
Below average	15.0%	27.3%	12.5%
Poor	0.7%	4.5%	0.0%
	44.0%	9.1%	50.9%
		31.8%	12.5%

* Mostly in lower half of group.

It would appear that only men with visual acuity of $\frac{5}{8}$ in each eye should be trained as "spotters."

HEARING.

The "spotter's" unaided ear plays an important part in locating the target, particularly at night, and the ears of "spotters" should therefore be free from disease and accumulations of cerumen. The opportunity was taken during this investigation to examine the ears of all the "spotters." Two out of the original 151 had a Hearing Standard II (A.C.I. 1428/1940), the remainder had Hearing Standard I, but in 40 per cent the removal of plugs of cerumen was required. It is therefore considered advisable to examine the ears of all "spotters" at three-monthly intervals and to syringe them if necessary.

¹ Of these, those that normally wear spectacles did so during this test.

SIMPLE TEST.

To test the night vision of a large number of personnel, it is necessary to use a simpler form of test, owing to the cost of an apparatus of the Livingston Hexagon type and the time factor limiting the number that can be tested on this machine.

Such a test has been in use in the R.A.F. and consists of a large black letter on a white or grey background. The letter can either be changed or rotated into different positions and a number of men can be tested rapidly against men previously tested on the Livingston Hexagon, one of whom should have obtained fairly high marks in the average group, say twenty, and another about eight or nine marks. The distance between the letter and the candidates is gradually increased. Those who do not do so well as the man who had previously scored eight or nine marks are placed in the below average group and not trained as "spotters." Those who do better than the man who scored twenty marks are placed in the above average group from which "spotters" should be drawn. The remainder fall in the average group from which "spotters" may be drawn if there are not enough men in the higher group. The eyes of those taking part in the test must be dark-adapted by wearing dark goggles (or by being kept in darkness) for forty-five minutes preceding the test.

A useful size for the letters is 15 to 18 inches square and 3 inches thick and letters such as C and E, that can be placed in four positions, are the most convenient. The letters should be moved five feet further away for each test and the candidates should be shown three letters at each position. The results may be written down, but notches or studs should indicate to the man on which line to write.

If there are no men previously tested on the hexagon available the test can be carried out comparatively and "spotters" chosen from those who do better than the others.

In bright moonlight the scotopic mechanism is not functioning fully and this test should not be carried out under such conditions.

The type of test described is not standard owing to the variable conditions of light prevailing but can be of great value in eliminating those who would be useless as "spotters."

TRAINING.

It is beyond the scope of this paper to discuss fully the training of the A.A. "spotter." An excellent article on this subject by Major (then Captain) Perowne, R.E. appeared in the *Journal of the Royal Engineers* in September, 1938. A few points only will be mentioned here. The quality of night vision may be improved with constant practice. With eyes fully dark-adapted "spotters" should endeavour to recognize at night the outlines of trees and buildings against the sky both with and without field glasses. Commencing with familiar outlines, the distance can be gradually increased, and use made of unfamiliar outlines. Large letters of the type used in the simple test may also be employed. The amount of training done in this way is only known to the "spotter" himself and depends very much on the individual's keenness.

The night vision of men who are congenitally deficient in red cells, or who are suffering from pathological changes in the retina or from myopia, will not, of course, be improved by these methods.

It is important to bear in mind that the object is always seen more clearly by the dark-adapted eye if it is not looked at directly but rather "out of the corner of one's eye." A clearer view of the object may also be obtained if the head is moved from side to side or up and down in order to obtain an image on a more sensitive portion of the retina. It is difficult to move the eyes slightly and accurately from side to side in darkness unless the head is moved.

A point which is probably not of great importance under present conditions is that excessive indulgence in alcohol or tobacco may adversely affect night vision.

The "spotter's" outlook towards his work is of great importance. If he is keen on his job and eager to see in the dark there is no doubt that he will see more than the man who is lethargic, even though the quality of their night vision be identical. In the past there has been a tendency to neglect the "spotter" and the other men in the detachment are inclined to look down upon him which causes him to lose interest in his work. Lectures on night vision were given to all "spotters" taking part in this investigation in order that they should know what was being done. Tremendous interest and keenness were shown and the improvement in their mental attitude on being "put on the map," as it were, was very marked. From experience gained during this investigation it is the writer's opinion that, although keeping men in darkness for forty-five minutes is an efficient method of dark-adaptation, the psychological effect on the man of providing him with dark glasses for this purpose is of value and should be fostered.

CONCLUSIONS.

- (1) That "spotters" of searchlight detachments are using night vision (rod mechanism).
- (2) That a number of personnel at present employed as "spotters" are valueless in this work owing to the poorness of the quality of their night vision.
- (3) That the efficiency of searchlight work would be increased if the selection of those to be employed as "spotters" depended on the possession of a high night visual standard.
- (4) That the night vision of personnel should be tested before training as "spotters" is commenced. Those who do badly in the test should not be employed as "spotters" but the actual standard set must depend to a certain extent on the personnel available.
- (5) That, owing to the cost of elaborate apparatus and the time factor, where large numbers are involved a simple type of test must be used to eliminate those with a low night visual standard.
- (6) That no other members of a searchlight detachment make operational use of their night vision except the man on the Mark 9 sound locator who is known as No. 6 but in this case it is not of great importance.
- (7) That some means of dark-adaptating the eyes of "spotters" before

they "take post" should be in operation on A.A. sites. This is best done by wearing dark goggles for forty-five minutes before dark.

(8) That intelligence and the desire to see in the dark play an important part in the "spotters" efficiency; and that the disparity between the A.A. and R.A.F. results is probably due to A.A. troops being less mentally alert.

(9) That "spotters" chairs should be adequately screened from ground glare and from the searchlight projector.

(10) That the results indicate that it is generally not worth while training as "spotters" those men with a visual acuity of less than $\frac{6}{6}$ in either eye.

(11) That the use of mydriatics such as paredrine hydro-bromide as an aid to night vision is impracticable in A.A. Units.

(12) That the diet of the A.A. Unit under investigation was not deficient in vitamin A.

(13) That a high standard of night vision is probably of importance in other branches of H.M. Forces. This particularly applies to look-out men on ships and to drivers of vehicles by night under the existing conditions of black-out and one wonders how many accidents have occurred owing to a sentry suffering from impairment of his night vision. The ideal, which is probably impossible to attain, would be for all personnel who are habitually employed during darkness to be chosen from the ranks of those who have a high night visual standard.

(14) That hearing is also of importance to "spotters"; that they should be examined at three-monthly intervals in order to remove plugs of cerumen if necessary.

My thanks are due to Group Captain Livingston, *C.B.E.*, *F.R.C.S.*, Consultant in Ophthalmology to the R.A.F., for his generous co-operation and advice and for the facilities he afforded me for using the Rotating Hexagon.

My thanks are also due to Flight Lieutenant Jeremy, *M.B.*, *B.Ch.*, and his staff for their able assistance.

I would also like to express my appreciation to Lieutenant-Colonel B. Chichester Cooke, *R.A.*, Commanding Officer, 00th S.L. Regiment *R.A.* for his co-operation in this investigation.

I must also thank Messrs. Glaxo Laboratories Ltd. for their generosity with regard to the supply of Adexolin Capsules, Messrs. J. & R. Flemming, Ltd. for assisting me to obtain dark-adaption goggles and finally the Ministry of Aircraft Production for supplying a certain number of goggles on loan.

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19 inches wide, was fitted inside the larger container to act as the disinfecting chamber. The dimensions will vary with the size of the containers actually available. In the model described, both steel drums were old ones obtained from a local Army salvage dump. They were thoroughly cleansed and painted before use as a disinfector. The inner container was made from an old drum used to hold bitumastic paint.

To raise the inner container off the bottom of the outer container, a criss-cross of timber about 6 inches wide was fitted inside. So long as it is large enough to hold a quantity of clothing, the actual size of the inner container is immaterial.

The inner container was cut open at the top so that when it rested on the wooden criss-cross, its top edge stood about 2 or $2\frac{1}{2}$ inches below the top edge of the outer container.

In the bottom of the inner container a circular piece of wood slatting was fitted to keep clothing, when being disinfected, away from condensed water.

Into the inner container a piece of 1 or $\frac{3}{4}$ inch piping was placed. This was bent at the bottom to form a right angle so that the short end projected about half-way along the bottom of the inner container. This formed the outlet pipe for steam, etc. The wood slatting can be made with a slot to allow the short end of the pipe to lie flat on the bottom of the inner container.

Around this pipe the clothing was packed tightly so as to leave no easy avenues for the steam on its downward path.

Over the projecting long end of this pipe the usual padded wooden cover to the outer container was then fitted. The pipe passed through a closely fitting hole in the wooden cover. If necessary, this joint can be made steam tight by a little clay.

The outer container was filled with water to a depth of 5 inches and was then placed over a trench fire, made of sticks or coal or an oil and water flash fire. The inner chamber, filled with clothing, was then placed in position and the cover fitted on and weighted down.

The disinfector functions as follows: The layer of water at the bottom boils, and the steam can only escape by passing up between the outer and inner containers and then over the edge of the inner container, to displace the air in it in a downward direction. This air escapes through the bent pipe and is forced out through its long projecting end.

When all the air is forced out, steam (in the form of water vapour when it reaches the atmosphere) will be seen to emit from the end of the pipe projecting through the cover.

Tests gave results as follows:

October 10, 1941: Blankets, 6 (standard type).

Time in all: 5 minutes for boiling (10 minutes if water cold).

25 minutes for steaming.

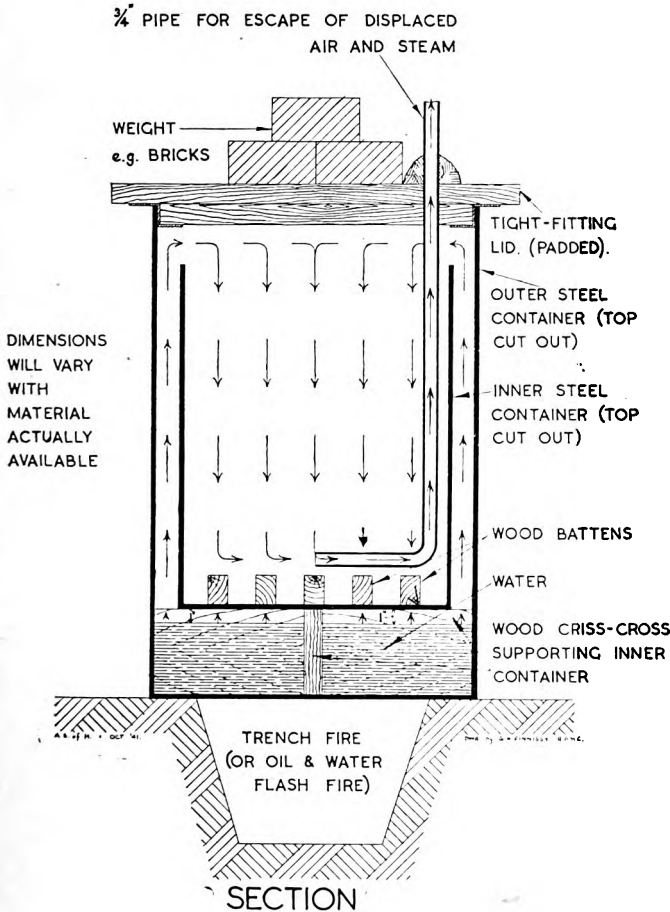
30 minutes.

11 Temoine tubes (methyl acetanilide and methyl violet) (100°C.).

All changed to deep violet without exception. The tubes were spread through the depth and width of the chamber.

Water used in half an hour—about $\frac{1}{2}$ inch of depth of 5 inches.

The drawing illustrates the simplicity of construction of this improvised disinfecter. The steam jacket between the inner and outer container keeps the inner container warm and prevents over-condensation. It may be well



to cover the outer container with old blankets or sacking if it is used in cold weather in an exposed position. The use of windscreens is also desirable.

WORKING SUGGESTIONS.

(1) Disinfection should be continued for twenty to twenty-five minutes after the first appearance of steam at the exit pipe since the inside of the inner container is usually damp. Thus the evaporation of this moisture,

as the apparatus becomes hot, may give a false impression that steam is coming through from the water in the outer container before this actually occurs. Therefore a half-hour period of disinfection invariably should be given.

(2) Articles to be disinfected *must* be packed round the steam pipe and also packed tightly throughout the chamber so that resistance to the downward passage of the steam may be evenly distributed and air pockets avoided.

SUITABLE CONTAINERS (probably available overseas).

A.—*Large Boiler*.—Standard steel drum, bulk oil type, 50 gallons. 34 inches high by 22 inches wide or thereabouts or similar container.

B.—*Inner Steel Drum*.—(i) Bitumastic paint drum, 24 inches high by 19 inches wide, or (ii) bleaching powder drum, 19 inches high by 16½ inches wide, or (iii) standard dustbin, 20 inches high by 17 inches wide.

It is, however, pointed out that any steam tight containers of convenient size may be used.

OTHER MATERIALS USED IN THE EXPERIMENTAL IMPROVED MODEL.

(a) One length of piping ($\frac{3}{4}$ or 1 inch) bent as shown (to suit size of container); (b) wooden padded cover with hole to fit steam pipe; (c) wood slat mat at bottom of disinfection chamber (this is best slotted as described above); (d) wood criss-cross, 6 inches high (this is best perforated with large holes cut by a 1 inch bit).

This method of constructing easily a disinfector in the field can be followed using a wide variety of salvaged material. Even two square tanks, so long as one is smaller than the other, can be used and would indeed make up a very satisfactory installation. The actual time taken to make the model described was four hours, no skilled labour being used.

My thanks are due to Colonel E. B. Allnutt, *M.C.*, Commandant, Army School of Hygiene, for permission to forward these notes for publication.

HYGIENE WITH A "FORCE."

BY MAJOR D. P. HOLMES,
Royal Army Medical Corps.

THE 00th Field Hygiene Section, having been formed, trained and mobilized, was duly despatched to "X" to supply Hygiene Service to a "Force." Trained in duties of the unit under usual campaign conditions and in the fitting of a Hygiene Section into the usual scheme of organization, they felt themselves well equipped with knowledge of how to deal with most difficulties. However, on arrival at the unknown destination they found the conditions were the reverse of usual in many ways and that the preconceived solutions to given difficulties either did not work or were not possible through lack of material. Moreover those difficulties so readily solved in textbooks by the simple expedient of "referring the matter to the appropriate technical unit" could not be so disposed of, as the "appropriate technical unit" was either not available or had many other duties on hand.

The Field Hygiene Section was therefore in the responsible but extremely interesting position of having the care of the health of the "Force" given into its charge—with full power to make or do anything to that end.

It may be considered that this was not an unusual position for such a unit. Nor, indeed, was it, but the uniqueness of the situation was not the breadth of duties nor the fact that the section had to carry out work usually performed by other technical units, but that the task had to be fulfilled with almost a complete absence of materials. It is part of the training of a Hygiene Section to insist that ingenuity must be used in improvising one material for another. An item that has not yet been added to the curriculum is how to do so when the unit has been disembarked upon an unsympathetic land where practically no material exists! The extreme shortage can in no way be exaggerated. Not only was no timber grown locally and therefore had to be imported, but this applied to every other variety of material. The question was, therefore, not one of improvising for the usual material, but one of finding *any* material capable of being used for a given purpose.

The notes are a brief account of experiences, of difficulties encountered, of good and bad remedies tried, with a description of some appliances designed to meet the needs existent.

The first difficulty was one of labour. This could obviously not be supplied from the limited personnel of the section and all other units were extremely busily occupied. It was finally overcome by the use of civilian labour under the charge of non-commissioned officers of the unit.

No workshop accommodation was available, so a store tent was utilized,

although this incurred a wastage of time in re-erection after each of the approximately weekly gales, and the recovery of the contents of the tent from surrounding ground! The next difficulty was complete shortage of material, timber being extremely scarce and corrugated iron sheeting non-existent. In fact the only material in plenty was the used petrol tin. It was found that these tins could be put to a number of uses, some of which will be described in the appropriate section. It must be realized that the remedies described for the various difficulties required quite a lot of experiment in almost every case and that the success was varied.

DISPOSAL OF EXCRETA.

Sewers were found to be few, far between, and where existent, primitive. Conservancy methods were therefore inevitable. The customary type of latrine with hinged flap at rear and communal seat was impracticable as there was insufficient timber available. Moreover, accommodation had to be elastic to provide for the needs of small detachments and large units. Seats were made to fit individual buckets, and were constructed to be self-closing and of fly-proof fit. They were reasonably satisfactory when properly used. This was possibly the least of the difficulties in this connexion and a very real one was disposal of privy soil. Disposal by burial was difficult as the country was made up of a very shallow soil stratum with rock at 3 to 4 feet. In many places outcrop rock over large areas was present. Incineration for anything other than dry refuse was impossible as, even if incinerators were improvised, no fuel was available for such a purpose.

Burial as deep as possible with careful supervision of trenches was the only immediate practical solution. It was not done without considerable difficulty and labour, particularly as many units were inexperienced in camp life. Care had to be taken with regard to fouling of ground later required for building purposes. A civilian service existed in towns by which excreta was collected from civilian houses and sea tipping carried out on to the foreshore. This was extended to make a military service for camps, utilizing civilian lorries, and civilian labour in charge of an N.C.O. of the section. Tipping was carried out at sites selected by the O.C. and the civilian M.O.H. at places where at least a 15 foot tide flowed. The method proved entirely satisfactory with supervision and care, although it is not considered advisable for prolonged use.

URINALS.

Following the immediate installation of open soakaways, methods of covering these and providing troughs were considered. No material was available for the usual trough and various experiments were tried using troughing made of bent tin or even of old motor tyre covers. These were universally unsatisfactory and the funnel type of urinal was decided upon. No funnels of any type were available, of course, and the inevitable petrol

tin was called into service. The first type of funnel used, and which was afterwards made for emergency and quick erection, was constructed of two petrol tins placed over the soakaway. The lower has the bottom perforated and the upper, placed angularly in the former, has a hole at the lowest corner, as shown in the diagram. It was found that, for constant use, these were too low, and that fouling of the surrounding ground occurred. A refined pattern, now in use throughout the force was designed and is shown in the diagram also. It is made as follows: The top is removed from a tin and a hole cut in the corner. A pipe made of an extended tin, flattened and rolled round a tent pole, is soldered in. It is completed by the addition of the filler cap, duly perforated as a filter. The pipe is let into the soakaway about 18 inches. An unexpected virtue in the funnels was extolled by the users, in the fact that they gave a certain amount of personal privacy and that micturition could be accomplished with a greater accuracy of aim! The latter point can only be appreciated when it is realized that units in camps had to tolerate high winds for long periods!

SULLAGE WATER.

It was found that, while urine soakaways worked well, soakage was extremely slow in soakpits provided for ablution benches and cookhouses due to absence of grease traps and poor soaking ground. The former was overcome, with fair success, by constructing grease traps out of metal, using the tin in which the cigarette issue was delivered. Sheets of tin were soldered in to give the "under and over" flow. Early models were unsatisfactory as the tin sides tended to buckle inwards from pressure on the baffle plates. This was overcome by placing wooden struts from side to side.

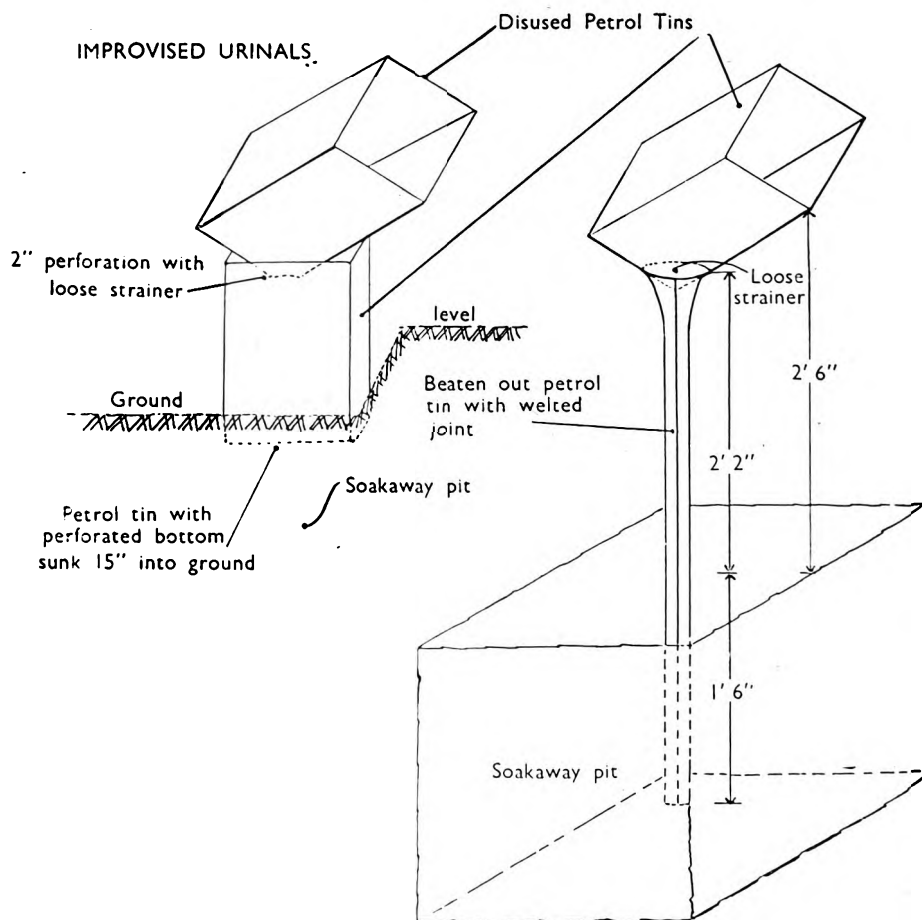
The question of ground soakage was more difficult as may be gauged from the fact that in one camp there was soakage capacity of over 1,000 gallons and the pits were always full. The best method found was that of digging pits in series with a final herring-bone drain as overflow from the pit. Three pits made up the usual battery and were constructed 5 feet long, 4 feet wide and as deep as possible, usually 4 feet.

ABLUTION.

Timber was obviously essential for ablution bench construction and the ideal was to minimize the amount used. Benches were therefore made and supplied to units in sections. Four trestle legs were made so that the bench could be completed by the laying on and nailing of two 6-inch planks along the trestle on either side, sloping towards the mid-line and leaving a centre gap. The whole was placed over a soakaway so that the man tipped the bowl towards the middle of the bench after washing: the water entered the soakaway via the gap. Bowls were provided from petrol tins cut to a depth of 6 inches and the cut edge turned over.

SWILL DISPOSAL.

The time-honoured method of disposing of swill to a local farmer for feeding his pigs was not possible as there were no pigs kept in the locality. A small proportion was disposed of as chicken food. Suitable containers for swill were in few cases available and a useful improvisation was made and supplied to all units from 5-gallon oil drums with a loose cover made of timber scrap. Burying of swill was not satisfactory for the same reason as excreta, and the greater proportion was tipped in a similar way.



When the necessities had been supplied, the question of increased comfort had to be considered, and the possibility of covering cookhouses, latrines, etc., arose. The Hessian screening was entirely unsatisfactory as the gales either laid it flat or even deposited it a considerable distance away.

Sectional buildings were therefore made by the unit and supplied for use in any connexion required. They were constructed of a framework

information and data. Original working had to be in the open, with consequent disadvantages of cold and lack of comfort. Furthermore, with the high winds prevailing, the showers were blown away from the would-be recipient. Hessian screening was unstable and inefficient and some improvement was obtained by erecting the showers inside a marquee with plant outside. This was fairly satisfactory, with an improvised brick floor, but frequent blowing down of the tent was an unsurmountable disadvantage. A final permanent installation was effected by provision of Nissen huts. The unit was then arranged as shown in the diagram and it will be noted that it readily allows bathing, or combined bathing and disinfection. A programme was arranged for bathing of units at set times and a period was set apart daily for disinfestation. Where disinfection was required, this was carried out in the A.S.H. disinfector followed by drying in the Millbank Disinfector. A table is appended showing approximate amount of work per hour that could be carried out as a routine, with three sets of showers working :

Bathing—100 men.	Disinfestation—200 blankets.
	Complete disinfection { 60 battledress suits, underclothing, greatcoats.

Nissen Hut accommodation for the Bath Unit was found very successful and refinements are in process of being added such as electric light for winter months, concrete paths, etc. Excessive steam in the bathing hut was an early disadvantage which it is hoped to overcome by the fitting of roof ventilators of cowl pattern.

As has been stated, units were often comparatively inexperienced in field conditions and the training of sanitary personnel was an obvious desideratum. Sanitary courses were instituted by the section and a model ground gradually constructed while structures in actual use were always available for demonstration. As may be gathered, the section and attached personnel have had a busy time, and all ranks have responded excellently to all demands made of them, whether of skill or labour. One's personal thanks are due to every member ; to select anyone would be invidious. In paying tribute to their technical knowledge and willingness, one knows that this will have benefited by the training gained at the "oldest and hardest University—Experience." Acknowledgements and thanks are due to Major W. J. Gregory, P.C., for the diagrams reproduced.

Editorial.

DYSPEPSIA.

"DURING the period between the dispatch of the B.E.F. and April 29, 1940, 12·5 per cent of all cases evacuated to the United Kingdom had a primary diagnosis of gastric or duodenal disease." So say Reginald T. Payne and Charles Newman after a very thorough investigation of the question, nor has the extreme incidence of stomach trouble in the modern British Army been denied but rather reinforced by all subsequent observers. Dyspepsia, *δυσ πεπτείν*, "a difficulty with the digestive process," has attained a menacing status in our Army statistics only in these latter days. Very little was heard of it during the Nile Expedition, the South African War or even during the last Great War, though it was commencing to make its presence felt at the end of hostilities in 1918. Payne and Newman made the position quite clear in their excellent memorandum during this present emergency. They examined a number of men sent from France to various Emergency Hospitals and saw every case in which a primary diagnosis had suggested a gastric or duodenal lesion. "Of 287 cases investigated, 201 were from France and 86 from England." They concluded that, of these cases, 89 per cent were of gross organic disease; that almost all were ulcers, the majority being duodenal, and that 92 per cent of the ulcers had been present before the war, a notable fact which should be constantly borne in mind. Tidy, at whose suggestion the work of Payne and Newman was carried out and who has been the inspiration of much of the work done in respect to dyspepsia in this country, has published several papers which add to the concern which should be felt with regard to this old disease so new in the British Army. Graham Gibson and Olaf Kerr, Allison and Thomas, Hutchinson, Saffley and Hinds-Howell have all brought their contributions and the literature is steadily mounting up to an imposing level. We read, in the *Medical Journal of Australia*, the other day, in the number published on August 30, 1941, a Leading Article on the subject which arrested our attention as being very much to the point. Millar of the Pennsylvania School of Medicine, speaking of the word "dyspepsia," is quoted as follows: "After all it is no more a diagnosis than hypertension, dyspnoea or jaundice is," but the term very successfully designates "a picture of disturbed gastric physiology." Again a recent book by Sir Hugh Devine of Melbourne is much praised as bringing to the question a highly intelligent surgical viewpoint and as a volume which should be closely read by all physicians as well as surgeons dealing with gastric cases. Dyspepsia, says Devine, is "an awareness of the process of digestion." He describes, according to the reviewer, a series of "patterns" of dyspepsia into which fit

the various medical and surgical pictures of the disease, or rather of the various diseases, concerned. "The main function of the stomach is its motor activity, that is, its filling and emptying." He divides the condition into four groups as follows: "Vitality dyspepsia" caused by disturbance of the vitality of the gastric or duodenal wall; "Functional dyspepsia" due to a disturbance of the neuro-muscular function of the stomach; "Reflex dyspepsia" caused by neuro-muscular reflex disturbance of the adnexa, appendix, gall-bladder, pancreas, etc.; "Organic dyspepsia" following organic disease of the stomach or the duodenum.

This approach, which we quote from the *Medical Journal of Australia*, seems to offer a reasonable means of appreciating this very complicated subject and so we offer it for what it is worth.

Although Tidy calls attention, in a recent communication both to the Royal Society of Medicine and the Corps Journal, to the paper by Denys Jennings which appeared in two parts in *The Lancet* of March 2 and March 9 of 1940, even reproducing one of the remarkable diagrams of that article with thorough appreciation of its value, we have not yet seen any real response to the challenge which Jennings threw to the Medical Profession to explain his main thesis. Why is it that, from about 1850 up to about 1905, the preponderance of ulcer of the stomach and therefore, we surmise, of dyspepsia, was so very marked in young women of the unmarried variety—for the married were mysteriously exempt—and why did this extreme susceptibility give place, at about the beginning of the present century, to a state of marked resistance as shown by the very group that was then most affected? And what is the reason why the young men, then largely exempt, are now increasingly the victims of this condition? If it were only the first question, we should answer with the guess that the change had been due to the alteration in the lives of young women which took place very much at the same time. For it cannot be denied that the daily lives of the poor girls of the last as well as the first years of Queen Victoria's reign were very different from the lives led by the young women of to-day! But why is it that the males of the present time show such a marked liability to dyspepsia and to the ulceration that forms the main feature of it? Can it be because the young men now spend a great deal of their time indoors at the desk instead of out of doors at the normal occupations of their sex? There can be little doubt that this is so to a considerable extent—or was so until the War brought a marked change and a great increase of air and exercise to the man of military age—but are not the young women of civil life very much immured in buildings for work or for pleasure, also? Perhaps what is natural for the female is fatal to the male!

Clinical and other Notes.

SPIDER BITE SIMULATING ACUTE ABDOMEN.

BY MAJOR W. H. HARGREAVES,

Royal Army Medical Corps,

AND

MAJOR K. G. F. MACKENZIE,

Royal Army Medical Corps.

A SHORT account of this case is considered worth recording because of the misleading nature of the presenting symptoms.

A Polish soldier, aged 47, was sent to hospital in Palestine during the night of August 2, 1940, with a tentative diagnosis of "acute appendicitis." He could speak no English and, on examination, was an obese individual, slightly cyanosed, shivering violently, with sweat literally pouring from all over him. His temperature was 97° F. and pulse-rate 88, the radial pulse being very weak. He was obviously extremely ill and appeared to have intense abdominal pain and to be in a severe state of collapse. He had vomited several times during his ambulance journey. Local physical signs were confined to the abdomen where there was generalized board-like muscular rigidity and extreme tenderness all over. The urine was normal. Perforated peptic ulcer was suspected, and he was admitted to the Acute Surgical ward. The Polish interpreter then arrived and a history was obtained.

The patient stated that he was perfectly well until about two hours before admission when, on undressing in his tent, he felt a sharp pain and found that he had been bitten on the right buttock by a black spider which was caught by his companions. Within half a minute of the bite, intense pain like agonizing cramp spread up his back to his head and down all his limbs, which felt paralysed, and later over the front of his body with violent abdominal pain and vomiting. His Regimental Medical Officer came to see him and sent him to hospital diagnosed as above.

The patient himself ascribed all his symptoms to the spider which, he said, was jet black with a round body about one centimetre in diameter. No sign of a bite could be found but this appeared to be the story of a *Latrodectus* bite and it was decided to treat the case conservatively with complete rest, abundant fluids by the mouth, warmth, morphia to relieve the pain and intravenous calcium gluconate—10 c.c. of a 10 per cent solution.

For three days he remained in a collapsed condition being very restless and in a cold sweat. He complained of much pain saying that all his muscles

were painful, including those of his face and jaw. All his teeth ached. Generalized abdominal rigidity and tenderness persisted but there was no spasticity of the limbs though the tendon reflexes were all brisk. No local lesion could be found in the right gluteal region. He remained afebrile but the profuse sweating continued. He took fluids well but became somewhat dehydrated, a blood-count on August 4, 1941, showing: R.B.C., 8,920,000 per c.mm. Hb. 120 per cent. W.B.C., 10,400 per c.mm., differential count normal. Rectal salines were given to combat the dehydration.

After three days improvement began and morphia was no longer necessary to relieve the pain which gradually subsided. In two weeks he was fit enough to be sent to a Convalescent Depot. There was still then some slight weakness and stiffness of the limbs. The spider, meanwhile, had been brought to the hospital and identified as an adult female *Latrodectus lugubris* (see accompanying lifesize photograph).



The best authenticated records of evil effects from the bites of spiders refer to a small group of spiders belonging to the genus *Latrodectus* of the family *Theridiidae*. In England attention was drawn to these spiders a few years ago when live specimens of the "Black Widow" spider, *Latrodectus mactans*, arrived at the Zoological Gardens in London. They were given much publicity by the popular Press as also was their destruction at the outbreak of war as a measure of public security. Fantastic accounts of the effects of "Black Widow" bites have been written in fiction of the sensational type.

The genus has a widespread geographic distribution, being known to occur in Southern Europe, Russia, Turkey, North and South America, South Africa, Madagascar, Australia and New Zealand. *L. mactans* was given its sinister synonym in California. In Palestine, according to Bodenheimer, two species occur; the dreaded malmignatte or the black red-spotted *L. tredecimguttatus* and the entirely black *L. lugubris* which may be the "Akis" of Transjordan whose bite the Arabs believe to be fatal.

Riley and Johannsen state that up to the end of 1937 there had been 600 reported cases of *L. mactans* poisoning in the United States of America with a mortality of 4 per cent. They give an interesting account of these spiders

and quote Kobert, who reported on a series of twenty-two cases of *Latrodectus* bite treated in Russia in 1888. They describe the venom as a toxalbumen which has been shown to be about fifteen times as potent as that of the prairie rattlesnake (*Crotalus albicans*). Generalized muscular pains of an agonizing character with nausea, vomiting, and profuse sweating, are described as the usual symptoms. Manson-Bahr states that the abdominal rigidity may simulate appendicitis. He describes the venom as a hæmolysin causing inflammation and œdema at the site of injection with numbness of the part, urticarial rash, nerve-pain, muscular rigidity and spasm and sometimes sloughing of the skin in the neighbourhood of the bite. There was no local lesion in the case now described, not even the mark of the bite being detectable.

SUMMARY.

A case of spider bite is described which presented symptoms of perforated peptic ulcer. The patient could speak no English and, if no interpreter had been available, he would undoubtedly have been subjected to a laparotomy.

Our acknowledgments are due to Colonel H. G. Peake, who commanded the hospital, for permission to publish this case.

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MODIFICATION OF PORTABLE DISINFESTOR.

BY CAPTAIN CRUICKSHANK,

Royal Army Ordnance Corps.

THE modification affects the method of heating the water in the boiler.

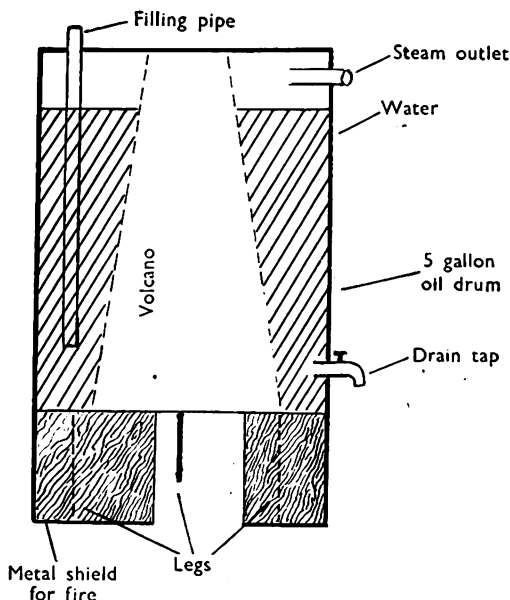
The boiler is the usual 5-gallon oil drum. In each end of it is cut a circular hole, 3 inches wide at the top, and 9 inches wide at the bottom end. Then, through the centre of the drum, is welded a metal cone made of some heat-resisting metal. The diameters of the upper and lower ends of the cone correspond to the two diameters of the holes cut in the drum ends. The lips of the cone are welded to the lips of these two holes.

Three metal legs are fixed to the bottom of the boiler. The last requisite is a strip of metal, whose width is slightly more than the height of the legs, of length approximately three-quarters the circumference of the drum and curved to correspond with the curve of the drum.

The filling pipe and steam outlet are as in the plan sent out by an A.D.M.S., the only other modification being a drain tap at the bottom of

the boiler, so that it may be used as a means of easily providing hot water in the field.

Operation.—Anything that will burn may be used as fuel. The boiler should be set up on a fairly open space, and the curved strip of metal should be adjusted round the legs so that the gap in it is facing the direction from which the wind is blowing. At the beginning, the "volcano" should be primed with paper. When this is alight, add a few small pieces of



wood and then some larger pieces. In a few minutes time, if there is a good draught blowing up through the volcano, the flames should be at or above the top. Keep it like this by adding bits of wood from time to time and steam should be obtained in about ten minutes.

The advantages of this method of heating are that it is more compact than an oil and water flash drip, one is independent of oil or petrol for fuel and steam is obtained quickly. As a means of obtaining hot water in the field it is excellent, the water becoming hot in a very few minutes.

THE USE OF THE 1 KW. LIGHTING SET IN THE TREATMENT OF SHOCK.

BY CAPTAIN D. A. G. BROWN,

Royal Army Medical Corps.

THE work of a main dressing station in the field is very largely concerned with the treatment of shock and the problem of treating numbers of shocked

patients simultaneously must be considered. The equipment provided enables three orthodox "tents" to be in use at once. In these the stretcher and the ground form the top and bottom of a hollow box of blankets supported by trestles.

I have carried out experiments using not only the standard tent heated firstly by the "stove oil boiling" and secondly by a number of hurricane lamps, but also using an electric cradle operated from the 1 kw. lighting set provided in the mobilization equipment of field ambulances. This paper shows experimental comparison between the various methods stressing the value of the 1 kw. lighting set in the treatment of shock. The value of this method has not, to my knowledge, been sufficiently emphasized, if in fact it has been described at all.

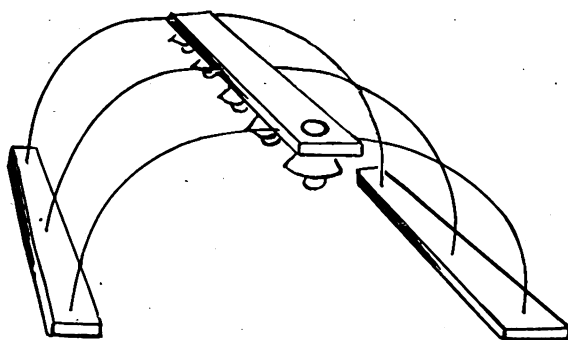
ESSENTIALS IN THE HEAT TREATMENT OF SHOCK.

The important features in the heat treatment of shock are :

- (1) That the patient should remain undisturbed on the same stretcher.
- (2) That the rise of temperature should be rapid and the maintenance economical.
- (3) That heat should be applied to the patient evenly.
- (4) That only equipment provided or easily and cheaply improvised should be used.
- (5) That the heating apparatus should not interfere with other treatment.

CONSTRUCTION OF THE ELECTRIC HEAT CRADLE.

The only requirements are three lengths of wood 2 feet 6 inches by 2 inches by $\frac{1}{2}$ inch, 6 yards of $\frac{1}{4}$ -inch mild steel wire bent into three half loops, five lamp holders, one switch and a length of flex, the total cost of



material being 5s. 6d. The five lamp holders are wired in parallel and the switch is incorporated in the circuit so as to control three of them and enable cutting down of power when the required temperature is reached. The wire hoops are threaded through holes bored in the wood. The bulbs and shades are supplied as part of the lighting set. Carbon filament bulbs would

produce more heat but their purchase would add to the expense and there would be danger of over-loading the generator. The whole cradle can be dismantled in a few seconds for carriage by simply threading the wood lengths off the wire.

EXPERIMENTAL COMPARISON BETWEEN THE THREE METHODS.

The time taken and the fuel expended in raising the temperature between the blankets of a stretcher through the arbitrary figure of 20° F. has been estimated. All these experiments were carried out in normal summer weather either in an open shed or in a tent. Patients were not used, the temperature being taken between the blankets where the patient would lie.

(1) Using standard tent heated by three hurricane lanterns.

	EXPERIMENT 1		EXPERIMENT 2		EXPERIMENT 3		EXPERIMENT 4	
Room temperature:	69° F.		71° F.		66° F.		60° F.	
Time	Temp. reached	Increase in temp.	Temp. reached	Increase in temp.	Temp. reached	Increase in temp.	Temp. reached	Increase in temp.
15 mins.	72° F.	3° F.	73° F.	2° F.	67° F.	1° F.	62° F.	2° F.
30 mins.	76° F.	7° F.	78° F.	7° F.	69° F.	3° F.	67° F.	7° F.
45 mins.	78° F.	9° F.	82° F.	11° F.	74° F.	8° F.	69° F.	9° F.
60 mins.	80° F.	11° F.	84° F.	13° F.	77° F.	11° F.	71° F.	11° F.
75 mins.	82° F.	13° F.	86° F.	15° F.	79° F.	13° F.	74° F.	14° F.
90 mins.	84° F.	15° F.	88° F.	17° F.	81° F.	15° F.	76° F.	16° F.
105 mins.	86° F.	17° F.	90° F.	19° F.	83° F.	17° F.	78° F.	18° F.
120 mins.	88° F.	19° F.	92° F.	21° F.	85° F.	19° F.	80° F.	20° F.

Experiments showed that a hurricane lantern burns oil at a rate of 18 ounces in thirty hours. This means that 3.6 ounces of paraffin oil are used in raising the temperature of one "tent" through 20° F.

(2) Using standard tent heated by one "stove oil boiling."

	EXPERIMENT 1		EXPERIMENT 2		EXPERIMENT 3		EXPERIMENT 4	
Room temperature:	62° F.		58° F.		58° F.		60° F.	
Time	Temp. reached	Increase in temp.	Temp. reached	Increase in temp.	Temp. reached	Increase in temp.	Temp. reached	Increase in temp.
15 mins.	74° F.	12° F.	71° F.	13° F.	71° F.	13° F.	74° F.	14° F.
20 mins.	77° F.	15° F.	74° F.	16° F.	74° F.	16° F.	76° F.	16° F.
25 mins.	80° F.	18° F.	78° F.	20° F.	77° F.	19° F.	79° F.	19° F.
30 mins.	83° F.	21° F.	82° F.	24° F.	80° F.	22° F.	82° F.	22° F.

This was using a medium flame. At this rate one pint of oil was consumed in five hours which means that 1.6 ounces of paraffin oil were used in raising the temperature of each tent through 20° F.

(3) Using 5-bulb shock cradle working on lighting set.

	EXPERIMENT 1		EXPERIMENT 2		EXPERIMENT 3		EXPERIMENT 4	
Room temperature:	58° F.		66° F.		58° F.		60° F.	
Time	Temp. reached	Increase in temp.	Temp. reached	Increase in temp.	Temp. reached	Increase in temp.	Temp. reached	Increase in temp.
5 mins.	66° F.	8° F.	73° F.	7° F.	64° F.	6° F.	67° F.	7° F.
10 mins.	78° F.	20° F.	87° F.	21° F.	78° F.	20° F.	79° F.	19° F.

The lighting set will run to full capacity for eight to nine hours on one gallon of petrol supplying 21 bulbs. Assuming that all four cradles were in use or at least that all 21 bulbs were in use for one purpose or another, the consumption of petrol in raising each cradle through 20° F. is 0.8-ounce.

SUMMARY.

It is shown by these experiments that the efficiency of the electric cradle is far in advance of either of the other methods, the cradle taking ten minutes to achieve a temperature for which the "stove oil boiling" required twenty-five minutes, and three hurricane lanterns 120 minutes. Further this result is obtained by an expenditure of only 0.8 ounce of petrol in the case of the cradle, as compared with 1.6 ounces and 3.6 ounces of paraffin oil respectively in the other two methods.

The further advantages of the cradle method are firstly that the patient is in no way disturbed. The cradle is placed over the stretcher on which he is brought in and blankets draped on it, a ground sheet covering the whole; lifting, tilting and arranging are reduced to a minimum. Secondly the heat is distributed evenly. This advantage is shared by the hurricane lantern method but not by the stove method. Thirdly, in a double ridge tent with its low sloping roof, it is much easier to administer plasma to a patient on the floor than to one supported on trestles as in the orthodox tent. Fourthly, the possible number of patients that can be treated is large. Certainly the lighting set will only light 21 bulbs, but although this represents only four cradles in the short phase of raising the temperature, it also represents ten cradles in the much longer phase of maintaining it. This argument does not apply equally to the other methods where no "thinning out" can be done. After a certain temperature is reached (about 30° F. above room temperature) it requires all three hurricane lanterns even to maintain it, and the "stove oil boiling" is of course indivisible.

Further work on this subject may bring to light flaws which I have overlooked but the conclusions which I draw from these experiments suggest that the lighting set offers a solution to what has always seemed to be a very difficult problem.

I am indebted to Lieutenant-Colonel J. C. McGrath, *M.C.*, for his permission to perform these experiments and to the Nursing Orderlies of the Field Ambulance for their valuable help.

A CASE OF BILATERAL GONORRHOEAL OPHTHALMIA CURED
WITH A SMALL DOSAGE OF M & B 693.

BY CAPTAIN N. BICKFORD,
Royal Army Medical Corps.

POLICE SEPOY K. B. a healthy young Bengali aged 23 was admitted to the Cantonment Hospital, Barrackpore, on June 26, 1941.

For the past ten days he had noticed a discharge from the urethra and for three days there had been redness of the eyes, lacrimation and pain. On examination both corneæ were bright scarlet, the lids were bulging and beneath there was a profuse discharge of thick yellow pus which, like the

urethral smears showed "diplococci morphologically resembling gonococci" in large numbers. The corneæ themselves appeared undamaged and there was no interference with vision.

He was put on hourly irrigations of mercurochrome and ordered M & B 693 on a massive initial dosage scheme, six tablets (i.e. 3 grams) six hourly for the first twenty-four hours. For some reason this order was not carried out and the patient only received two tablets t.d.s. On the 27th his temperature rose to 101° F., but there was a marked improvement in the condition of his eyes. By the 30th the temperature was normal, the redness of the corneæ had disappeared and the discharge was so slight that the irrigations were cut down to two a day and by the 4th, eight days after admission, the eye condition was normal, the urethral discharge had ceased and he was already asking for sick leave. Vision was then better than 6/5 with either eye and no trace of damage could be detected. The M & B was continued to a total of 35 grams and he was discharged after the usual tests of cure.

The remarkable features of this case seem to me to be firstly the response to what one would have considered an utterly inadequate dose of the drug and, secondly, the extraordinary rapidity and completeness of the cure. This is the more remarkable when one considers the time and place, Bengal in the middle of the Monsoon, where any purulent condition is notoriously hard to check.

I am indebted to Colonel W. B. Rennie, *M.C.*, *M.B.*, *A.D.M.S.*, *P.* and *A.* District, for permission to submit these notes for publication.

BLACKWATER FEVER AND BLOOD TRANSFUSION.

By MAJOR A. KERR BOYLE, *M.D.*, *D.A.*,

Royal Army Medical Corps.

BLOOD transfusion is not indicated in every case of blackwater fever nor does it in any instance obviate the need for other therapeutic measures. In the toxic polyuric and in the relapsing types of this disease, however, its value in the early stages is undeniable. The best method in these cases is one of small transfusions, 300 to 450 c.c., given slowly and repeated as often as required. The hæmatological data and the clinical condition of the patient are the guides to the necessity for blood transfusion, the amount of blood to be given and the frequency of administration. Citrated blood (10 c.c. of 3·8 per cent sodium citrate solution to each 100 c.c. of blood) is better than whole blood, especially in the polyuric type where there is often evidence of a lowered alkali reserve. In tropical West Africa at the present time and under the existing circumstances the founding and maintenance of a blood depot is impossible. Blood must be given as soon as it is taken. A system of voluntary donors grouped, registered and called upon when the need arises is the only practicable scheme. A limited amount of

blood only can be taken from a donor who may himself be a sufferer from malaria, an anæmising disease, shortly thereafter. Severe reactions and undesirable sequelæ are to be avoided by a rigid adherence to the well-established rules governing the technique of blood transfusion. Routine grouping of donor and recipient is but a preliminary; direct compatibility tests are imperative. The presence or absence of agglutination must be confirmed by examination under a microscope. Absence of clumping of the erythrocytes to the naked eye is not enough. The donor's blood must, of course, be free from parasites and the fragility of its contained red cells must be within normal limits. Measures are necessary to prevent cooling of the blood during and after collection.

The Marriott-Kekwick apparatus supplied to the Army Medical Services is provided for continuous drip blood transfusion and is quite unsuitable for small volume transfusions. It is unwieldy and for its proper functioning requires a supply of oxygen. The "unit" supplied for the reconstitution and administration of dried serum or plasma, however, can be easily adapted. The 12 ounce medical flat containing 200 c.c. of sterile water is emptied, resterilized, and 30 c.c. of 3·8 per cent sodium citrate solution are added. This serves as the transfusion bottle and, partially immersed in a hot water bath, the blood is taken directly into it. It will hold 300 c.c. of blood. Gravity alone is sufficient to maintain a flow of blood if a wide-bore needle is inserted into the donor's vein. After use the unit is thoroughly cleansed and resterilized; it is then ready for further service. The simplicity of the outfit commends its use in a trying climate and under tropical conditions. If a volume of blood larger than 300 c.c. is desirable, a suitable bottle, into which the rubber bung of the component part will fit securely, will serve as the container. The Medical Research Council outfit designed for the stored-blood method would serve admirably for fresh-blood transfusions.

I am indebted to Lieutenant-Colonel W. R. C. Spicer for his permission to publish this article, to Major K. S. Thompson and Captain I. G. Cameron for their unstinted help and advice. The enthusiasm of the Theatre staff calls for no little praise.

ANAPHYLACTIC REACTION ON IMMUNIZATION WITH TETANUS TOXOID.

BY LIEUTENANT C. G. M. DONALDSON,
Royal Army Medical Corps.

ON August 18, 1941, the reaction described below occurred in a healthy man, aged 24, giving no history of asthma, hay-fever or urticaria. In July, 1940, 1 c.c. of tetanus toxoid had been administered followed, after an interval of six weeks, by a similar dose, without the occurrence, on either occasion, of any reaction.

Twenty minutes after receiving 1 c.c. tetanus toxoid by the deep subcutaneous route he complained of intense itching in groin and axillæ. This irritation rapidly spread to the remainder of the skin and within a few minutes vertigo and swelling of the lips supervened. There was no difficulty in swallowing. When seen shortly afterwards the eyes were suffused, the face was flushed and there was marked œdema of the frontal and infra-ocular regions. The skin of the trunk and limbs was bright salmon in colour and numerous weals, the largest some 7 by 3 inches, were present. Temperature was normal, pulse-rate 130.

One grain of ephedrine hydrochloride caused a rapid improvement in symptoms, a second similar dose two hours later being sufficient to make the patient fit for duty.

The same batch of toxoid has been used on over 40 other occasions without reactions appearing.

SUMMARY.

A severe reaction to tetanus toxoid occurring in a type not known to be predisposed to such reactions is described.

Quick return to normal on exhibiting ephedrine is noted.

Faulty material is excluded by the absence of reactions in other cases.

A list of references to published reports on severe reactions to immunization with tetanus toxoid is given below.

REFERENCES.

- COOKE, R. A., HAMPTON, S., SHERMAN, W. B., and STULL, A. (1940). *Journ. Amer. Med. Assoc.*, **114**, 1854.
 CUNNINGHAM, A. A. (1940). *Brit. Med. Journ.*, ii, 522.
 PARISH, J. J., and OAKLEY, C. L. (1940). *Ibid.*, i, 294.
 WHITTINGHAM, H. E. (1940). *Ibid.*, i, 292.

Current Literature.

FRIMODT-MÖLLER, C. **A Scheme of Control of Tuberculosis in India by "Organized" Home Treatment.** *Indian M. Gaz.* 1940, Oct., v. 75, No. 10, 577-81. [Summary appears also in *Tropical Diseases Bulletin*.]

The author points out the great dissimilarity between conditions in India and those in Europe in regard to the existence of facilities for controlling tuberculosis, and shows that there is no possibility of the early provision of institutions on such a scale as to be capable of receiving the mass of tuberculous persons (estimated by some as 2 millions, by others as many as 5 millions).

The scheme which he puts forward he calls "organized home treatment," the aim of which is to apply as much as possible of modern specialized treat-

ment and prevention to the patients and contacts in their homes. Though institutions cannot cope with the whole problem, it is necessary that as many as possible be formed as the basis from which modern methods can be carried into the homes. The tuberculosis clinic is therefore essential and should be instituted in every large city. At this clinic artificial pneumothorax treatment should be given. Hospital wards and sanatoria should be provided wherever possible, since surgical collapse of the lungs will be needed.

Facilities for training of medical men and the ancillary services would exist in these institutions, and the author emphasizes the importance of collaboration between specialist staffs and general practitioners. After-care is necessary and the provision of colonies will eventually be needed. Education of the sick, the relatives and of the general population must be provided for.

The paper is written in general terms, but the reasoning is sound and the plan perfectly feasible.

C. W.

Reprinted from "*Bulletin of Hygiene*," Vol. 16, No. 5.

DE, S. P., and PAUL, S. **Bacteriophages in Calcutta Sewage.** *Calcutta M. J.* 1940, Aug., v. 37, No. 8, 499-510.

Sewage from underground drains serving a densely populated area of Calcutta was tested over a period of twelve months for the presence of bacteriophages against a range of organisms. Several strains of each organism were used and the phage activity of the sewage filtrates was judged by the percentage of strains completely or partially lysed. Throughout the year phages potent against *Bact. typhosum*, *Bact. paratyphosum A* and *B. Bact. flexneri* and *Bact. shiga* were readily isolated. Phages to *Bact. sonnei* and *Bact. enteritidis* (Gärtner) were also of frequent occurrence, while phages acting on *Ps. pyocyanea* and *proteus* were rare.

It was found that the number of phages active against the typhoid bacillus increased during the enteric season. *V. cholerae* phages, not present in large numbers from August to December, were isolated with rising frequency as soon as cholera became epidemic. The same seasonal variation was noted in a survey of open surface sewers. It was thought that phages might be found in larger numbers in these drains owing to the better aeration, but this did not prove to be so.

J. C. CRUICKSHANK.

Reprinted from "*Bulletin of Hygiene*," Vol. 16, No. 5.

SMILLIE, W. G., and JEWETT, OLGA F. **The Relationship of Immediate Family Contact to the Transmission of Type-Specific Pneumococci.** *Amer. J. Hyg.* 1940, Nov., v. 32, No. 3, Sect. A, 79-88, 8 charts.

This paper deals with an interesting aspect of the epidemiology of pneumococcal infections as occurring in the City of New York.

Cultures were made from the throats of (in the main familial) contacts of cases over periods ranging from six months to more than a year, similar observations being made on families of non-contacts.

The number of contacts from 83 cases studied was 318 and the total number of cultures made from them 535. There were 29 non-contact families comprising 193 persons from whom 631 cultures were investigated.

The results are set forth in detail in the case of three "contact families" and of three "control" families. These definitely show that Type I and Type II pneumococci become widely distributed among those living with patients in whom these types have been the causal agent of pneumonia. The carrier state thus induced in families may persist for several months.

Among non-contacts, on the other hand, types other than I and II are prevalent and the type varies in a single individual from one examination to another.

Thus Type I was found in 10 per cent of *all* cultures from contacts, but only in 0.8 per cent of controls, the corresponding figures for Type II being 7.4 per cent in contacts and 0.3 per cent in controls. This contrasts markedly with, for example, Types III or XIX which were found with almost equal frequency in contacts and non-contacts.

A point worthy of note that emerges from these observations concerns the multiplicity of types of the pneumococcus which may be simultaneously present in the secretions of the nasopharynx. Infection with four types occurs notably in the first lustrum, it is less frequent in the second lustrum, between the ages of 10 and 14 simultaneous infection with three types were encountered and after fifteen years only two.

It is concluded that Types I and II are invasive and are possessed of high power of dispersion and are, therefore, of special importance from the standpoint of epidemiology.

W. J. TULLOCH.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 5.

Reviews.

THE TREATMENT OF BURNS. By A. B. Wallace, M.B., F.R.C.S.Ed., M.Sc. McGill. Oxford University Press. London: Humphrey Milford. 1941. Pp. xiv + 113. Price 5s.

This little book gives an adequate description of most of the methods in vogue for the treatment of burns, including the Bunyan-Stannard envelope, without however giving a very clear guide as to which method is most favoured by the author.

The treatment of burns shock is given in detail, and contains some useful information, though the author appears to have overlooked, in his enthusiasm for intravenous therapy, that fluid may be given by mouth with advantage. The nakedness of the children in illustrations 6—9 does not lend support to the belief (expressed on p. 42) that exposure aggravates secondary shock.

The book may be of some value to junior house surgeons and to nurses.

THEORY OF OCCUPATIONAL THERAPY FOR STUDENTS AND NURSES. By Norah A. Howorth, M.A.Cantab, M.R.C.S., L.R.C.P., D.P.M., and E. Mary Macdonald. London: Baillière, Tindall & Cox. 1940. Pp. x + 132. Price 6s.

The authors have rendered a distinct service by producing their little book at this particular time.

The value of Occupational Therapy was recognized during the last war in Germany, in Canada and in the U.S.A.; and, resultant upon this recognition, departments were set up in the majority of large hospitals in those countries which have functioned usefully ever since. In England, Occupational Therapy was allowed to lapse with the result that the present war finds us with a demand which we are completely unable to meet.

Occupational Therapy is of value in three directions; diversional, rehabilitational and revocational. Although the first of these may be met to some extent by amateur workers, a thorough groundwork in anatomy, physiology and psychology is often necessary in the speedy rehabilitation and revocation of the wounded soldier.

This book, written by a doctor and an expert occupational therapist, presents in a simple and modest—perhaps too modest—way, the purposes which occupational therapy serves and the technique by which these may be obtained. The reader will have little difficulty in realizing that there is more in this subject than is commonly believed.

BULLETIN OF THE HEALTH ORGANIZATION OF THE LEAGUE OF NATIONS. Vol. VII. No. 4. Pp. 73. Price 2s. 6d.; \$0.65. Annual subscription (6 numbers), 15s.; \$3.75, post free.

The *Bulletin* of the Health Organization of the League of Nations gives information concerning the activities of the Organization.

Among other items the volume contains two reports of outstanding interest. The first is a report by the Commission on Physical Education, drawn up at a meeting held in Geneva in July, 1938. This report will repay a study by all who are interested in scientific research relating to physical education. The Commission suggests a programme of laboratory research on the physiological effects of physical exercise and on the relations between intellectual and physical development. In addition it enunciates some general principles for the use of those taking part in physical exercise and gives a draft examination form to be used for the medical examination of persons engaged in physical training.

The other report of particular interest is one dealing with certain technical aspects of nutrition. The question of the guiding principles to be observed in the study of diets and the nutrition of populations is specially dealt with together with certain special considerations which should be taken into account in regard to nutrition in the Far East, in tropical countries and in colonial territories. Furthermore, attention having been drawn to the

fact that there exist in Europe circumstances so critical as to necessitate emergency measures against famine, the authors of the report have suggested diets, very simple and inexpensive, but adequate to maintain life and to avoid severe malnutrition.

LECTURES ON WAR NEUROSES. By T. A. Ross, M.D., F.R.C.P. London: Edward Arnold & Co. 1941. Pp. viii + 116. Price 6s., net.

This war has, fortunately, given rise to very few of the acute war neuroses and hence there has not been so far any great output of medical literature on the topic. The ordinary neurotic difficulties, conditioned in part by mal-adjustment to Army life, have been very much to the fore, however. They constitute a problem to every medical officer and a major cause of the invaliding, as in civilian life.

These lectures by Dr. Ross are shrewd, readable and refreshingly informal. Experience of the last war and of an officers' hospital in this war has been combined with Dr. Ross' great experience in the intervening years and the product is as stimulating as his other well-known books. Ross' recent death is indeed a great loss to psychological medicine but he has left behind him work which makes us think more clearly. The reader of these lectures will remember for long his wise remarks about exhaustion, as also that "The introduction of the sphygmomanometer was a disaster from which we have not yet recovered."

Ross has always stressed the part which the general practitioner should play in the management of the neuroses. Here he emphasizes the task of the unit M.O. and he certainly offers him help. This is a small book worth reading.

J. R. R.

A TEXTBOOK OF THE PRACTICE OF MEDICINE. Edited by Frederick W. Price, M.D., C.M., F.R.C.P., F.R.S. Sixth Edition. Oxford Medical Publications. Oxford University Press. 1941. Sections I.-XXI. Pp. 1891. Price 38s., net.

New editions of few textbooks on medicine are more eagerly awaited than "A Textbook of the Practice of Medicine," edited by Frederick W. Price. This sixth edition has appeared within four years of its predecessor. Here the text has been brought well up to date.

It is observed, however, that under treatment of bacillary dysentery no mention is made of drug therapy with sulphaguanidine, reports of which are so encouraging, especially in the more severe and fatal forms of the disease. Lymphopathia venereum is the name under which climatic bubo is now described. This disease is recognized as being almost world-wide in its distribution. Its response to sulphapyridine, if administered in the early stages, is usually very satisfactory.

Spirochaetal jaundice, a disease not uncommon in this country, is included in this edition. The typhus fever group is classified into flea, mite, tick and

louse typhus, according to the host vector or rather the suspected vector, a not altogether satisfactory method. A short account of the more important vitamins is given, followed by a description of the conditions resulting from deficiency of each of these vitamins.

A number of new articles on less common conditions have been added, including Epidemic Myelitis, Functional Branch Bundle Block, Congenital Cystic Disease of the Lung, Acute Disseminated Encephalomyelitis, Acute Febrile Polyneuritis, etc.

This new edition should certainly be added to our Medical Library.

Notices.

PRICE REDUCTIONS.

ROCHE PRODUCTS, LTD., WELWYN GARDEN CITY, HERTS.

"PROSTIGMIN" AMPOULES AND CONCENTRATED SOLUTION.

Ampoules (1 c.c., 0.5 mg.) in boxes of 6 and 50 are reduced from 5s. and 30s., to 4s. and 24s. respectively.

Concentrated Solution (5 c.c. phials) is reduced from 11s. per phial to 6s.

Tablets.—Packings of 20 will now be 8s., instead of 9s., packings of 250, 76s. instead of 80s. Packings of 100 are unchanged at 37s.

"EPHYNAL" (VITAMIN E) TABLETS.

"Ephynal" is stated to present vitamin E in a stable and convenient form.

The bottles of 30 and 250 are reduced from 5s. and 36s. 9d. to 3s. 6d. and 19s. 6d. respectively. Bottles of 100 tablets at 9s. will be available shortly; also "Ephynal" Forte Tablets each containing 20 mg. in bottles of 20 and 100, at 10s. and 40s. respectively.

"OMNOPON" PREPARATIONS.

Purchase Tax is no longer chargeable on "Omnopon" preparations (excluding "Omnopon" combined with Scopolamine).

"LIQUEMIN" HEPARIN.

"Liquemin" Heparin solution is now being changed to contain approximately $2\frac{1}{2}$ times the strength of the old solution.

"TRIOFAX."

"TRIOFAX" Triple Dye Jelly, the issue of which is announced by Burroughs Wellcome & Co., is a convenient medium for the application of the triple dye treatment recently advocated for burns of the hands and face.

The product contains gentian violet, brilliant green and euflavine, incorporated in a stable water-soluble jelly which is easily and quickly applied to the injured surface. "Triofax" is issued in collapsible tubes of two sizes.

SULPHAGUANIDINE.

IN view of the general interest in the use of Sulphaguanidine (Sulphanilylguanidine) for the treatment of bacillary dysentery and its proposed application in the surgery of the colon and rectum to reduce the number of coliform organisms, Burroughs Wellcome & Co., inform us that, subject to priority demands, "Tabloid" Sulphaguanidine 0.5 gm. is available to the medical profession.

SCOBENOL.

WE have received from Messrs. Boots Pure Drug Co., Ltd., a sample of their new preparation "Scobenol."

This is a clear liquid which is said to contain 25 per cent benzyl benzoate, 25 per cent soft soap and 50 per cent isopropyl alcohol. It has the advantage of being stable and its ingredients do not separate into layers when the bottle is left standing.

Scobenol has been introduced for the treatment of scabies. The makers recommend that the patient should anoint his whole body with soft soap, rubbing with special care those parts commonly attacked by *Sarcoptes scabiei*; he then lies in a warm bath for $\frac{1}{4}$ to $\frac{1}{2}$ hour. Scrubbing with a nail-brush is not specifically advised (this appears to be an unfortunate omission), but it is recommended that when he leaves the bath and is still wet the Scobenol should be applied with a shaving brush all over the body. This dries in 10 or 15 minutes and a second application is made. The patient then resumes the clothes worn before the treatment was started and must not wash nor even immerse his hands in water for the next 24 hours. At the end of this time a cleansing bath is given and clean clothes put on. For heavily infected cases a second treatment is recommended.

It is interesting to find that Messrs. Boots recommend that "all members of a family or household should be treated on the same day, even though they may not show any signs of scabies." This, we think, is an extremely wise provision, as it is now known, though not widely recognized, that persons may suffer from scabies and yet show but few of the signs and symptoms.

Scobenol contains slightly less benzyl benzoate than some other preparations on the market but it should prove to be an efficient addition to our therapeutic armamentarium.

Authors are alone responsible for the statements
made and the opinions expressed in their papers.

Journal of the Royal Army Medical Corps.

Original Communications.

"BLITZKRIEG."

AN APPRECIATION.

By BRIGADIER E. M. COWELL, C.B., C.B.E., D.S.O., T.D.

THIS is the title of a small book written by F. O. Miksche and recently published by Faber and Faber Ltd., London. The author, an officer of the Regular Army of the Czechoslovak Republic for twelve years, served with distinction with the Republican forces in the late War in Spain. The book is described by Tom Wintringham in his introduction as "a Continental, a European essay on Tactics."

Lieutenant Miksche writes with a sound knowledge of German tactics and a practical experience of Total War. He is in a position to be able to describe not only the plans for attack on the new lines exploited by the Germans with their armoured and motorized forces but also the methods to be adopted in defence in depth, as employed so brilliantly by our gallant Russian allies to-day.

All medical officers in a Field Force will perform their duties with success proportional to their knowledge of tactics. Whether it be the Regimental Medical Officer or the Director of Medical Services, medical arrangements will fail unless the tactical situation be studied, understood and appreciated from a practical angle.

In war many of us have found that the medical services function at their best when they cease to be "A" and become "G."

In "Blitzkrieg" the teaching is sound, practical and so important that all Medical Officers in the Field are advised to read, absorb and apply the lessons without delay.

In *Chapter I* a study is made of the reasons which led to the downfall of France and of the methods of Total War adopted and practised by the Germans in the Battle of Flanders, 1940.

Infiltration, both tactical, economic and political, is described and the Maginot psychosis is suitably dealt with.

The old doctrines of Clausewitz have been revived and brought up to date. Attack is superior to defence because it forces the defence to operate under unfavourable conditions.

The basal factors of the German Blitzkrieg are surprise, speed and superiority in material and fire power.

The German doctrine teaches the value of local superiority. Reconnaissance by contact units having revealed a weak spot, troops are concentrated on a narrow front and an intense attack delivered. This becomes possible by improved transport methods, superiority in fire power and perfected communications including the use of wireless. The fighting force hits hard and swiftly by means of its tanks, lorried infantry and air arm.

These methods were worked out by Germans fighting with Franco's Army in Spain.

In *Chapter II* a study is made of Spanish fighting, commencing with the Battle of Guadalajara, March 8, 1937. Here 150 Italian tanks achieved a local success but two motorized divisions of six battalions each and on separate roads failed to advance with sufficient speed. Bad weather conditions bogged the vehicles so that a surprise Republican air attack on the 12th created panic and a complete rout of the Italians. Next day, supported by forty heavy Russian tanks, the Republicans successfully continued the attack.

At Brunette in July, 1937, tanks again failed because they operated on a wide front in accordance with the French theories and did not form a spear head, tactical thrust-point or "Schwerpunkt," supported by guns and aeroplanes, according to the German plan.

At Bilbao, in the same year, a break through was secured on a narrow front hardly a thousand yards wide. This gap was enlarged by the direction of the attack being switched laterally to cut communications, shooting up the defence from the rear.

Another important lesson from Spain is the value of fortified villages and towns as islands of resistance for all-round defence; this will be referred to later and is of interest from the medical point of view.

Chapter III.—At the end of the Spanish War new methods of attack were worked out and used for the first time by the Fascists. In Aragon motorized columns pushed forward at the rate of twenty-five miles a day while in Catalonia the pace was doubled, largely owing to concomitant air attack.

In Poland in 1939 the tempo was again increased, largely by means of overwhelming air superiority, Fifth Column activities and destruction of all Polish intercommunications.

Tank units broke through the wide Polish front, a pinning attack was made on every position the Poles took up and resistance was finally crushed by further attack from the rear.

These lessons were not appreciated by the French. In 1940 General Gamelin expected a repetition of the German move of 1914 and disposed his strongest force in front of Brussels, leaving two weak armies to defend a front of ninety miles. It was here that three German columns crossed the Meuse on narrow fronts, May 12-13. This took the French by surprise, because the Ardennes were thought to be impassable owing to lack of railways and roads. But there were enough roads for armoured and motorized formations. This "irruption," which was an advance on narrow fronts, took place at such speed that Abbeville was reached ten days later, May 24.

In the second phase of the fighting after the evacuation of the B.E.F. the French waited on the "Weygand Line," and did not attempt any counter-manceuvre or counter-infiltration. On June 8 three narrow breaches were made through which seven Panzer Divisions were poured and which continued to advance some thirty miles a day. This ended the French resistance.

This success resulted from the new conception of warfare. The Germans attack the enemy flanks or rear and achieve this by searching for and piercing the defence on narrow fronts.

This narrow gap is not wide enough for slow-moving masses but will permit fast-moving vehicles to pass through.

On a twelve mile front intensive attack may be concentrated on two or three points, each headed in a divergent direction so that Panzer Divisions, having broken through, can attack the defence zones from the flanks and rear.

This method is described by the two German words "Schwerpunkt" and "Aufrollen."

A "Schwerpunkt" or thrust-point implies the continual seeking for the weakest points of resistance, the application of a locally superior force and the constant maintenance of initiative and surprise.

The "Aufrollen," which alternates with the movement of the Schwerpunkt, is the immediate and methodical exploiting of each local success by side thrusts which protect the flanks of the advancing units.

A modern battle is no longer fought along a wide front but over wide areas. The line has given place to the column and operations are conducted in great depth.

Chapter IV.—In this chapter the basic factors for success, initiative, surprise and speed, as outlined by Clausewitz, are again emphasized.

Whereas troops used to move on the approach march at 15 to 25 miles a day, they now advance at 100 to 150 miles a day. It is estimated that with motorization the pace of development of any tactical situation is six or seven times faster than previously. Main forces can be moved rapidly from their concentration areas in any direction required, using roads and not railways. These areas may be 100 to 150 miles away from the foremost enemy forces,

so far away that the massed attacking force threatens not one but many sectors of the enemy front.

Actual physical concentration is no longer necessary. All that is needed is an elastic grouping which allows of rapid movement.

The factors determining the choice of the strategical thrust-point are:

- (i) The road system centring on the attack sector.
- (ii) Roads on the enemy side with diverging routes.
- (iii) The position of the enemy's strategical reserves.
- (iv) The presence of lateral roads to allow of rapid transfer to a new sector if the first attack fails.

Plans for the first phase in the move up from the elastic concentration to the regrouping zone include movement of units in the order in which they will go into action.

The second phase of the approach march is from the regrouping zone to the point of contact.

The normal order of march will be:

- (i) Armoured (Panzer) Divisions.
- (ii) Shock Divisions (specially trained, provided with extra weapons).
- (iii) Motorized Divisions.
- (iv) Normal Infantry Divisions.

Advanced echelons may travel 12 to 24 hours ahead and will consist of:

- (i) Reconnaissance troops working with air co-operation and including staff and commanders, who travel in plain battle-dress in lorries on trucks and not staff cars.
- (ii) Traffic control, including A.A. units and anti-paratroop personnel.
- (iii) Supply parties, organizing petrol, food and water.
- (iv) Repair units, including workshops and L.A.D.s.
- (v) Engineers, responsible for bridges, by-passing obstacles, etc.

Immediately behind these advance echelons come the assault troops whose task it is to make the gap. When this has been made further troops are brought up and poured through to consolidate the position and widen the breach.

The supply problem is met by motorized divisions themselves carrying double loads and including motorized supply columns in their formation.

Petrol requires a special organization which is as follows in the German Army:

- (i) Tanks are fitted to provide a range of 180 miles.
- (ii) Petrol lorries are attached to furnish another 100 miles.
- (iii) Independent petrol columns are convoyed forward to re-fuelling points.
- (iv) Roadside dumps are established to refuel lorries moving to the rear.

To ensure success a highly trained staff is necessary to prepare staff tables and to co-ordinate movement. The latter is done through traffic control units and air reconnaissance by wireless.

Air superiority is vital for this operation.

Chapter V.—In this chapter the Air Arm is considered. A third dimension is added to warfare and modern battle is the fight for cubic space. In addition to fire superiority, air superiority is of vital importance to-day.

The attacking side chooses its air thrust-points, "Luftschwerpunkt" in addition to the ground Schwerpunkt. Modern air tactics were worked out by the Germans operating with the Fascists in Spain. All forms of attack were practised, from dive bombing to firing woods by incendiary bombs and so driving out the defending troops.

On the Ebro in the Autumn of 1938, high altitude bombing, low flying attacks and dive bombing were all employed.

The air arm is used in battle for the following purposes: Air Reconnaissance, Protection, Liaison, Supply and Support.

Air reconnaissance is only possible in the presence of air superiority and involves continuous observation of both our own and the enemy's troop positions with perfect communications to signal and report centres. Protection is afforded by a fighter screen over the enemy rear and an "umbrella" overhead, together with bombers which attack roads and communications in addition to bombing aerodromes. These bombers may afford flank support to advancing formations.

When the air arm is used as artillery, areas can be neutralized by various types of bombs or covered by machine-gun or cannon fire.

The German organization for air co-operation includes the following methods:

- (i) *Long-range combat*, where fighters accompany bombers 20 to 40 miles in enemy territory.
- (ii) *Long-range reconnaissance*, flying at 9,000 to 15,000 feet, using photography.
- (iii) *Tactical reconnaissance*, at 5,000 to 9,000 feet, reporting troop positions of both sides, giving positions and observing for the artillery.
- (iv) *Fighter reconnaissance*, to down enemy machines, to lead friendly bombers and to do bombing themselves.
- (v) *Counter-battery and main bombardment*, carried out by bombers who attack enemy artillery during the approach march of the forward attacking units. They then switch to bombing the enemy's chief zone of resistance and finally drop a curtain of metal behind the enemy's main positions cutting them off.
- (vi) *Close support*, where machines, chiefly of the dive-bomber type, accompany the ground "assault groups" (Angriffsgruppen) bombing targets which are their immediate objectives and neutralizing enemy guns.
- (vii) *Reserves*.

An Air Army Corps of the German Air Force consists of one Fighter and three Bomber Divisions with a total of 1,656 machines.

The Air Arm may develop a useful function in dropping supplies; one machine can carry petrol for 20 tanks for 100 kilometres or rations for 400 men for one day.

Some of these machines may be sent to reinforce the squadrons of the Panzer Divisions in a “blitz.”

Chapter VI.—The merit of the tank as a weapon lies in its capacity for rapid manœuvre. To achieve success the attack must be on a narrow front and must be accompanied by close support from the air.

Battle success depends on mobility and not on fire power. Tanks push through a defensive position, help their own Infantry through and then appear in the rear of the defenders. When bunched and concentrated they are less vulnerable to anti-tank weapons. A light Panzer battalion attacking in “block” formation covers 30 to 40 acres and is more easily controlled than a wave attack over a wide front.

A Panzer Division consists of two armoured brigades each of over 200 tanks and a Jaeger brigade of three battalions, with Sappers, Artillery, Signals and other Divisional units. Accompanying the armoured division may be one or more motorized divisions, consisting of three lorry-carried infantry brigades with two artillery brigades attached, an air reconnaissance squadron of nine machines, a light battalion of armoured cars and carriers, divisional artillery, engineer and other services.

“Shock” Divisions also exist, consisting of highly trained mobile troops, moved as required in lorries especially detailed.

These three formations complete the “Panzer team.”

Chapter VII.—The Panzer team is used to form the thrust point. Coming up against a defence position with no weaknesses and no flanks, it smashes its way through by sheer force. This process is termed “irruption.”

Following irruption, the shock divisions enter the gap, “infiltrate” and diverging laterally, immediately proceed to “roll up” the defence positions from the flanks and rear. While this is going on the motorized divisions press on through the gaps in the defence zone, driving the main thrust deep into the enemy territory.

The normal infantry divisions, which form the main body of the German Army, continue the process, exploit the situation and secure a decisive success.

Such an attack may be expected to be launched on a twenty kilometre front with three main thrust points each two kilometres wide. The edges of the breach are kept open by air bombardment and widening is immediately secured by attack from both flank and rear. The motorized and other units only enter when the breach is five or six kilometres wide.

To achieve such a break through on an enemy divisional front the Germans use a team of six or eight divisions.

A Blitz attack may be mounted in four echelons:

- (i) *The reconnaissance echelon* consists of one tank battalion which carries out its duties by fighting. It attacks on a 300 to 500 yard front and goes for guns, dumps and command posts, spreading panic as it advances. This dash is supported by dive bombers, and the tanks protect their flanks by an all round field of fire.
- (ii) *The combat echelon* is the main body. Advancing on a slightly wider front it extends the breach sideways for the following echelon.
- (iii) *The third echelon*, that of infiltration, consists of light tanks and motorized infantry in cross country lorries. Once through they debus, hold the positions gained, spread out over the enemy lines of communication and occupy key positions.
- (iv) *The mopping-up echelon*, composed of assault groups, either battalions or brigades with supporting arms, is thrown into the breach with orders to wipe out all traces of resistance, to widen the breach and to establish and hold the bridge-head.

Through this bridge-head pass the motorized divisions, whose task it is to exploit the success of the operation. Behind them again follow the normal divisions.

The initiative must be maintained by the attacker and the pursuit continued relentlessly. Units leap-frog through each other alternating the processes of advance and consolidation.

The pursuit must be co-ordinated; it is not necessary to establish a continuous front. The motorized units leading use the smaller roads, by-pass areas of resistance, occupy points of strategic value and hold the ground gained until relieved by larger formations. Motor-cycle battalions play a large part in the advance and during the whole time the air arm continues to function.

During this advance the armoured formations move forward in reserve, relying on air reconnaissance for information of an enemy counter-attack.

Chapter VIII. The Combat Teams.—This is a fascinating chapter in which the author descends from the height of tactics of high formations to the all-important level of unit and sub-unit fighting.

Miksche, having described the methods of Blitzkrieg, points out that the Infantry are still required in these decisive battles. Not the infantry of 1914-1918 but an infantry incorporated in "combat teams" or perhaps better described as "assault groups," working in teams of combined arms organized and trained to fight together.

The normal infantry division may move at three miles an hour and co-ordinating orders take a very long time. The motorized modern divisions move at fifteen miles an hour and with modern arms and equipment possess dynamic power. Because of this power battle to-day consists of a great number of small actions fought by assault groups which may be companies, battalions or brigades.

Here is the picture of a Blitz against the old infantry division.

The approach march on one or two roads provides a target which invites air attack. Where the division is deployed on a 4 or 5 mile front, only a portion of its guns and anti-tank weapons can come into action at any given time. Enemy tanks appear, dive bombing takes place and the enemy breaks through to the rear, attacking command posts and crushing resistance.

The secret of the success of Blitzkrieg does not lie in German material superiority but in the Allies' tactical inferiority.

When infantry are opposed to mechanized forces they can only contribute towards a decision by adopting a method of "filtration"; that is, they find out strong positions by fighting reconnaissance, avoid them, and filter through until they encounter the rear infantry divisions and supply columns which are following these mechanized forces.

This manoeuvre of bringing infantry through to the rear of a mechanized enemy is called "counter-filtration." The German terminology for this method is significant, "*die Lücken und Flächentaktik*" (the tactics of the space and the gap), in distinction to the old tactics of an advance in line on a continuous front.

For the success of this manoeuvre "a psychological re-orientation" of the troops is necessary. They must learn to fight with full confidence even when surrounded.

The solution of the problem lies in the formation and employment of the assault groups already referred to, "*la tactique des groupements combinés*." The basic elements of such groups are:

- (i) Close support weapons to form a fire base, its main protection.
- (ii) Covering units to protect these close support weapons.
- (iii) Shock troops to advance forward or to a flank.
- (iv) A reserve in the case of the larger team formations.

Whilst small teams of 16 men may be used, the average size is that of an infantry company or battalion with sufficient equipment for independent fighting—including anti-tank guns.

The next groups are:

- (i) The brigade, which is an infantry-artillery group, and
- (ii) The division, an infantry-artillery-air group.

Of the divisional troops which assume a leading role in modern fighting the Germans attach great importance to a motorized battalion of engineers, whose tasks include the laying of mine-fields and the making of anti-tank obstacles.

The methods of attack follow the plan already described for larger formations, i.e. the *Schwerpunkt* and the *Aufrollen*, and may include a simultaneous attack on both flanks of the objective by two groups, the pincer movement.

Assault groups are organized in depth with reserves which can be flung into action where resistance is weak and so attack the main resistance from the flank or rear.

The Staff and Commands work from within reserve groups, companies,

battalions and brigades in the case of battalions, brigades and divisions respectively. Continual reconnaissance by air and other means is essential and wireless welds the groups into co-ordinated manoeuvre.

The author concludes this chapter by drawing attention to the vast importance of the fighting qualities and morale of the individual members of all groups. "Morale is decisive."

"We are entering a period when only armies that are inspired by an ideology can fight well." Leadership, man management, initiative and again morale are vital factors.

And an essential factor in this sort of morale to-day is a political ideal, some aim connected with making and remaking the World, that is suitable to the epoch in which we are living.

Chapter IX.—This is a chapter on the artillery and describes the methods of employment of the normal divisional gunner units.

With the normal methods of co-ordination between infantry and artillery a very considerable time lag exists between the receiving of a request for and the opening of fire. This allows fast moving targets to escape.

In warfare of to-day, with the need for more rapid action, a satisfactory result can only be obtained where "a large part of the artillery is integrated into the actual framework of infantry units." The gunners must advance with the infantry, partly for their own protection but mainly to secure the most intimate co-operation.

Part of the work of the artillery has been taken over by the air arm, chiefly in "preparatory" and "close-support" fire. Protective, long range and counter-battery work is now almost entirely the work of the air force. Counter-preparation will be carried out by the air force if it possesses superiority.

In defence the task of the artillery assumes greater importance, including putting down protective barrages, fire against tanks and support for short counter attacks.

The main function of the artillery to-day is to neutralize targets difficult to locate from the air and to deal with small and moving targets, i.e. destructive fire.

In attack, prolonged fire can be put down by the heavy artillery on roads, road junctions, bridges and villages deep in the enemy positions, i.e. harassing fire. This can be carried out at night.

Another function is to protect or "wall in" the flanks of an assault group, "box barrage." This may be shared with the air arm.

To destroy tanks, fire must be directed against the tanks themselves, by direct laying and firing over open sights. It is not sufficient to put down a barrage over the area through which the tanks are travelling.

When the artillery is decentralized, its fire can cover a larger area, it gains greater flexibility, observation is facilitated and initiative encouraged.

With this system it is more difficult to secure large concentrations of

fire on the same target but dispersal improves protection since concealment from the air is easier for small groups than large masses of guns.

The assault group system, with guns as part of the infantry network, affords protection to the gunners who otherwise are open to surprise attack by air-borne troops or paratroops.

These same remarks apply also to decentralizations of both anti-tank and light A.A. guns to infantry battalions.

The divisional artillery is so decentralized that the C.R.A. has but little left for him to control.

(To be continued).

LECTURE TO ALL MEDICAL OFFICERS.

BY COLONEL K. COMYN.

THERE are some of you who have come direct from civilian medical practice into Army medical routine. It is to those I wish to speak of the intricacies of such routine in an endeavour to help you in your difficulties and make such routine easier for you. Of those of you who have already considerable Army experience I would crave your tolerance if I tell you much that you know already and I hope that perhaps you may glean a few tips that may be, even to you, of some benefit.

We all want our Service to be as nearly 100 per cent efficient as possible, and that efficiency, both from the professional and from the statistical point of view, begins with the work of the Ward Medical Officers in a hospital and with the Regimental Medical Officer in the field. It does not matter how efficient the senior staff officers either in a hospital or in the field may be if the ward or regimental medical officers are inefficient or do not show keenness and initiative in their work.

DIFFERENCE BETWEEN CIVIL AND MILITARY PATIENTS.

You must first grasp certain fundamental differences between civil and military patients. You will then realize that your treatment of them varies to some extent accordingly.

The soldier must be either fit for full duty or else in hospital. He should very rarely be "Excused Duty" or on "Light Duty"—consequently civil patients are usually *more* ill, more seriously ill before you see them. There is a greater proportion of trivial cases among soldiers in hospital. A civil patient is generally better off in his own home than he is in hospital unless seriously ill: it is the reverse with a soldier—he is always better off in hospital than in a barrack room. In Army life, especially in war time, there is always a proportion who are malingerers—a small proportion—they are much rarer in civil life. Then there is a large number just now who either purposely with an eye to the future or subconsciously from lack of spirit or determination to fight against them, attribute all their ills to France and/or the Service. The true malingerer is very hard to detect. The one who is subconsciously making the most of his ills is much easier to detect and should be treated firmly and not pampered—many can thus be cured.

FUNCTIONS OF MILITARY MEDICAL SERVICE.

Your essential basic duties as military medical officers must next be properly understood and your actions based accordingly. In civil life, the doctor's interests which guide his actions are threefold: (1) His professional interest in the case; (2) to a slight degree a financial interest; (3) the welfare

of the patient. I do not know which is the correct order in which these interests should be enumerated. In military life we are servants of the Government and, through the Government, of the Public. Your interests or duties, for professional interests become duties when you join the military medical service, are threefold while the war lasts: (1) The prosecution of the war by whatsoever medical means you can; (2) the welfare of your patients and safeguarding of their interests; (3) the safeguarding of the Government and the Public against financial loss that can be avoided. That is definitely the order in which your interests or duties must be carried on. Hard though sometimes it may be, the welfare of your patients must at times be subordinated to the common good and the prosecution of the war.

Briefly speaking, your duty in the prosecution of the war is to get every man possible fit enough to do some form of military duty even if he cannot do the full normal duties of his arm or branch of the Service. Conversely, your duty is to get out of the Army as quickly as possible all men who are obviously unfit for any form of military service. Every sick man or man excused duty or on light duty constitutes a burden on his unit and delays that unit's training, efficiency, mobility and striking power. This duty of the medical officer whether regimental M.O. or M.O. doing duty in a hospital is of the utmost importance and constitutes the primary function of the military medical service, namely to maintain the strength and efficiency of the fighting forces. Hence the most important part of your work in a hospital is your decision as to the disposal of patients and what effect treatment will have on their disposal. On the one hand we have to avoid loss of man power and on the other hand we must avoid hampering units with unfits or semi-fits and lengthy occupation of hospital beds which may be required for emergencies or war casualties.

The question of disposal of patients, especially those that are unfit, is closely related to the third important part of your duties—that of safeguarding the State against undue financial loss. This is the main object to be achieved by invaliding and medical boards and depends upon the accurate recording of such data as will enable the Ministry of Pensions to fix the degree of attributability or degree of aggravation or otherwise of any disability with which a soldier leaves the Service or of which he may complain at any subsequent date. This is applicable both ways, not only to safeguard the State against the man who unjustifiably claims that his disability is attributable to service but also to safeguard the man who leaves the Service with his health broken through military service without compensation. The former is all too common—the latter very rare. A number of cases undoubtedly occur in which men claim compensation either after being demobilized or at the end of their military service in which insufficient recording of illnesses or injuries during their service prevents the Ministry of Pensions forming an accurate assessment of causation and the men have to be given the benefit of the doubt.

For these reasons a greater amount of recording, i.e. paper work, is

necessary in the Army Medical Services than in civil life, and the greatest accuracy is necessary in such recording. Before speaking in detail of this paper or statistical work I must mention very briefly a few words of advice on the purely professional side of your work. In Army life we are much more liable to criticism, or rather of criticism being passed around, than we are in civil life and unfortunately adverse criticism goes round far more widely and much more quickly than favourable criticism. Bearing that in mind it is necessary for us to be a little more cautious in certain ways. Here are a few hints which may save us much adverse criticism even though quite undeserved. Never fail to see and speak to every patient under your immediate care every day, even if it is only to ask him how he is. Always fully examine every medical patient and every surgical case which is not obviously a trivial injury such as a cut finger or a sprained ankle. You will think it unnecessary to call your attention to this yet it is astonishing how frequently complaints are made after patients have left the hospital, especially officer patients; such complaints as "The Medical Officer never examined me," or "I was not told whether to stay in bed or what food to take," or "I was in hospital five days and only saw the medical officer once," etc. One case I remember of an irate C.O. of a cavalry regiment phoning me to come and see him because the regimental M.O. had visited him and had told him he had a feverish cold but did not take his temperature, did not look at his throat nor examine his chest, did not tell him whether to stay in bed or get up or what food to take. In this particular case the patient had only a slight cold, but that medical officer's reputation in the station was dead and the prestige of the whole medical service there also suffered considerably, though I helped to raise it somewhat by doing my best to choke the aforesaid officer with a spatula and throat swab, by pummelling his chest as hard as I could, by putting him to bed on a starvation diet and then giving him the most unpleasant concoction of *sodæ salicyl*. I could devise. He recovered from his cold and he thought me quite a good doctor.

ADMINISTRATIVE DUTIES OF WARD M.O.s.

Then there are certain administrative duties to be carried out by those of you who are in charge of wards or departments. As I said before, the efficiency of a hospital begins with the ward medical officers. Their duties are not only professional. Each ward medical officer should try to look upon his ward or wards as a separate hospital of which he is O.C. He should, on his morning round, have a keen eye for the general ward management, e.g. cleanliness and tidiness of the ward and of bed linen, sufficiency of pillows, cleanliness of patients, the warming and ventilation of the ward, cleanliness of annexes, bath, bedpans, urine bottles, W.C.s, sufficiency of latrine paper, effectiveness of flushes, cleanliness and orderliness of ward kitchens, crockery and utensils, prompt investigation and reporting of breakages. A great deal of this is the duty of the Sister in charge but it must be remembered that many of these Sisters have come straight from civil life and have not

worked before in a military hospital. Then the M.O. should be sure that his diet sheets are kept up to date and that the dieting is strictly based on two considerations: (1) the patient's health; (2) hospital economy. Chicken, Low and Gastric Diets should only be ordered when thought absolutely necessary on medical grounds and not because the Sister thinks the patient "a nice man" or that he "needs feeding up." There is too great a tendency to leave the dieting entirely to the Sister in charge.

He must not forget too that the responsibility of training orderlies rests largely with him. Good nursing orderlies are not made by lecturing alone but actual practical instructions in wards by M.O. and Sister will create keenness and efficiency.

STATISTICAL SIDE OF MILITARY MEDICAL SERVICE.

Now I come to the statistical side of military medical work. It is, of course, very irksome to all of us and much more so to those of you who have only recently come from civil practice and are new to what is commonly referred to as "Army Red Tape." Unfortunately the efficiency of a hospital is often judged more from unsatisfactory records and reports which leave it than from highly efficient skilled treatment that is enacted within it. Therefore efficiency in both sides of the work is essential.

The purposes or general principles for which these statistical records are required are:

(1) To keep every patient's unit and/or Record Office informed where he is when he is under medical care.

(2) To keep the War Department informed of the numbers off duty from sickness and therefore what reinforcements or replacements are required to maintain the unit's strength.

(3) To provide the War Department with accurate data from which (a) annual statistics of sickness from all over the world wherever our troops are, and (b) the medical history of the war, can be compiled.

(4) To complete an accurate medical history of each man serving in the Army, while he is so serving.

(5) To safeguard the State from undue wastage and unnecessary additions to the pensions bill.

(6) To compensate the individual soldier for disability or injury directly attributable to or aggravated by his military service.

First as regards the means by which every man's unit is kept informed. When a man is admitted to hospital, A.F. B-256 (Sick Report) should accompany him. One copy of this is signed by the M.O. receiving him at the hospital and returned to his unit, thus informing his unit of his admission. The second copy is sent to the ward with any notes on it as regards symptoms or treatment which the M.O. may wish to convey to the Sister or M.O. in charge of the ward. It should then be sent to the Statistical Office for filing. As a result of Army Form B-256 being received by the unit, three very important things are done: (a) The man is struck out of

rations from the following day; (b) his kit is collected from his barrack room and put into the Quartermaster's Store and an inventory taken; (c) the Pay Serjeant makes any necessary adjustments to his pay. Then also A.F. B-178, the man's medical history sheet, is sent to hospital by the unit, if they have it, or by the O. i/c Records if it is there.

Secondly, to keep the War Department informed of the numbers off duty from sickness. On the morning after admission, A.F. W-3017, Report of Admission to a Military Hospital, is sent (i) in the case of officers and nurses, two copies to the War Office (Casualty Branch) and one copy to A.M.D.2 (Medical Statistical Branch), (ii) in the case of other ranks, two copies to Officer i/c Records concerned. The same form is similarly sent on discharge or transfer from the hospital, if it is a military one. In the case of admissions to/or discharge from an E.M.S. Hospital, Form E.M.S. 105 takes the place of A.F. W-3017.

These forms keep the War Office constantly informed of the numbers of men going sick, but not of the incidence of sickness, because many of these cases must of necessity be shown as N.Y.D. on the first day of admission. To supplement this information and give more accurate figures, A.F. A-2024, Return of Patients Admitted as Direct Admissions During the Week, is sent to the Under-Secretary of State, A.M.D.2, War Office, every week on Saturday mornings giving the total numbers by diseases admitted up to Friday midnight. This does not give names, but does give units. It also shows a small summary of beds equipped, available and occupied in military hospitals at home. This form does not show cases transferred from other units but only direct admissions. It is rendered by all field ambulances, C.C.S.s, general hospitals in the field, general and military hospitals at home and overseas. The numbers admitted to E.M.S. Hospitals are reported on E.M.S. Form 105, which takes the place of A.F. W-3017, and A-2024 has no counterpart in such hospitals. Military Hospitals at home also keep the A.D.M.S., D.D.M.S., and O.C. Station, and through these the G.O.C. Command, informed of the situation as regards numbers of sick and numbers of vacant beds by rendering A.F. A-27 daily. This is the Morning State of Sick, and shows the numbers of sick by units, officers and nurses by name and disease, cases put on the D.I. and S.I. List, and deaths whenever they occur. It also shows number of beds occupied and vacant.

When a patient has been off duty from sickness for twenty-one days (in the case of A.A., R.A. Units the period is three months), he is struck off the strength of his unit and placed on the "Y" List, coming automatically on the strength of his Depot. This enables his place to be taken by a reinforcement and the O.C. to gauge more accurately what his requirements are likely to be in the way of replacements. The striking off strength and placing on the "Y" List is done by the O.C. Unit in Part II Orders.

It will be seen how important it is that, whenever a patient is detained or admitted by a medical officer, whether an orderly medical officer or an

officer doing out-patients, a B-256 or a slip in lieu, with the man's details, is sent as soon as possible either by the M.O. or the Sister i/c the ward to the statistical, chief clerk's or enquiry office and that diagnosis be written up on the diet sheets as soon as definite diagnosis can be made with accuracy.

RECORDS OF SICKNESS IN THE ARMY AND MEDICAL HISTORY OF THE WAR.

The next purpose for which medical statistics are required is to compile accurate records of sickness, with details of treatment and disposal, among British forces throughout the world.

In peace time, this is done in two ways: (1) by annual returns compiled from the Admission and Discharge Books (A.B. 27) accompanied by reports of specialists and of special cases, epidemics, etc., and (2) by A.F. I-1220, the Hospital or Sick List Record Card. In war time, the annual reports are done away with and I-1220 constitutes the main statistical record held by the War Office. This form is therefore one of the most important documents with which we have to deal. I-1220 is made out for every patient admitted or transferred to a general hospital in the field or at home and every military hospital at home. In the field every individual admitted to a Field Ambulance or C.C.S. has A.F. W-3118, Field Medical Card, and W-3118A, Envelope, made out, if he has not already got one. This, together with any temperature chart or medical notes follows the patient from one medical unit to another. When finally discharged to duty, died or otherwise disposed of, the W-3118 and notes in W-3118A are sent by post to the Under-Secretary of State, A.M.D.2, War Office, each Saturday.

A.F. I-1220 is prepared for every patient admitted or transferred to a general hospital. This replaces the W-3118 if the patient is admitted direct to a general hospital or is in addition to it if he is transferred from a Field Ambulance or C.C.S. The I-1220 does not accompany the patient from one unit to another, but on the Saturday in each week the A.F.s I-1220 relating to each patient discharged to duty, transferred to a convalescent or other Depot, or another hospital or hospital ship, or who died, will be sent to the Under-Secretary of State (A.M.D.2).

With regard to entries on A.F. W-3118, there is little space available and only essential notes should be made. The most important of these are date, time and place of wound, injury or onset of sickness; whether morphia, any such drug as M & B 693, Sulphanilamide, etc., prophylactic serum, etc., have been administered.

ENTRIES ON A.F. I-1220.

We now come to the compilation of A.F. I-1220. This is prepared in the first instance in the statistical or head office of the hospital from details in the A. & D. book, obtained either from the sick report sent to the hospital with the man, or from details taken in the reception office when the man arrives, or from a slip sent from the Ward. It is a remarkable thing how many errors occur in these A.F.s I-1220 of a patient's regimental num-

ber, or initials or the spelling of his name, or his unit or whether he is transferred from some other hospital—frequently some such details are omitted altogether. It is essential therefore that all these details are checked up as soon as possible at the bedside with the verbal statement of the man himself. This should be done by the divisional wardmaster. The medical officer should also verify these details on the diet sheet, although this is not such an important document and does not usually go outside the hospital. They may however be called for by the A.D.M.S. or D.D.M.S. or Officer i/c Supplies periodically for inspection. It should be remembered that the more important of these cards are photographed to produce duplicates and, should any question be raised subsequently concerning any man's illness or accident, his treatment in hospital or the result of any such treatment, the duplicate may be called for. Also, should any statistical work on certain diseases or epidemics or group of disabilities or any research work be gone into, these photographed facsimiles may be obtained on loan from the War Office.

For these reasons all entries must be very legible, and written in good ink. The diagnosis should be in block capitals and must conform to the Nomenclature of Diseases. It should be remembered, too, that they may be studied either at the War Office or Ministry of Pensions, where names of local specialists, etc., are not known and mean nothing, but that it is the opinion of such officers or the result of their treatment that is essential. Such entries as "Will Major please see"—or "to see Medical Specialist," etc., with no further remarks as to result, mean absolutely nothing. Such entries should be as follows: "date . . . seen by Surgical Specialist . . . advised . . .", or "date . . . treatment as advised by Medical Specialist . . . carried out . . . result satisfactory," or "Improved" or "Cured."

Then opposite condition on discharge, one often sees "I.S.Q." That will not do. If the patient cannot be shown as "Cured" or "Improved," then there must be some note as to the disposal or further treatment, i.e. "to attend M.I. room for further treatment"—"Medical Board recommended Category 'C'"—"to be seen by . . . Specialist at a later date for treatment, recommended light duty till then."

It is also of the utmost importance to record briefly all treatment given. The negative effect of treatment often affords as valuable information as positive effects—e.g. in arthritis cases the effect of salicylates, rest, radiant heat; and in gastric cases the effect of dietetic and medicinal treatment. There is often a great tendency to rush patients to the X-ray room, thereby causing a considerable expense in X-ray films, wear and tear of tubes, and strain on working time of the X-ray Department. At the same time the recording of any preliminary treatment and its effect on the disability forms a very important part of the patient's medical history.

With regard to diagnosis on A.F. I-1220. If a diagnosis once made and entered proves to be wrong, the first diagnosis is crossed out on the A.F. I-1220 in such a way that it is still legible and the new diagnosis is

written in block capitals above it, the correction also being made on the diet sheet and a slip sent to the statistical office. When a patient is suffering from two diseases, he will be shown as admitted for the more important or serious one and the second one mentioned stating on the A.F. I-1220 its treatment and progress. Should the second disease persist after his recovery from the one for which he was admitted he will be shown as discharged on the date on which he recovered from the first disease and as readmitted the following day for the other disease.

Should another disease supervene on that for which the patient was admitted, the fact will be noted in the "remarks" column of the A. & D. book and on the A.F. I-1220. Should the new disease persist after the patient has recovered from the first disease, he will be shown as discharged on the date on which he recovered from the first disease and readmitted the following day for the new disease.

A.F. I-1220 must be made out for every case admitted or transferred to hospital. This includes cases as above in which a second disease persists or a new disease supervenes and persists, for which a new card must be made out to agree with the new entry in the A. & D. book. Every admission in the A. & D. book has a serial number and this must agree on the A.F. I-1220.

On January 1 each year a new card with a fresh serial number is made out for every patient in the hospital.

To summarize the requirements of A.F. I-1220:

- (1) Legibility with good ink.
- (2) Accuracy of man's details of number, rank, name and initials.
- (3) Correct diagnosis in block capitals and in accordance with Nomenclature.
- (4) Statement of treatment given and results thereof.
- (5) Disposal and condition on discharge.

A.F. I-1220 must not be kept at the bedside or where a patient can get access to it.

MILITARY PATIENTS IN E.M.S. HOSPITALS.

Military patients admitted to E.M.S. hospitals and civilian casualties admitted to military hospitals have slightly different forms and they do not have A.F.s I-1220.¹ These forms are chiefly E.M.S. 105, M.P.C. 46, 47 and 42. E.M.S. Form 105 takes the place of A.F. W-3017 and is sent in duplicate to the Officer i/c Records for a soldier in an E.M.S. hospital. M.P.C. 46, casualty card, is made out for every casualty whether military treated in an E.M.S. hospital or civilian treated in a military hospital. This is in the form of a tie-on label which is made out at the first aid post or dressing station. All medical documents are placed in a war casualty cover or envelope—M.P.C. 47—which is transferred with the patient wherever he goes and on final discharge is sent to the Ministry of Pensions Casualty Records Section.

¹ A.F. I-1220 has now been adopted by the E.M.S.—*Ed.*

On discharge of the patient, a form M.P.C. 42, classification of injuries schedule is made out and sent to the Casualty Record Office, Ministry of Pensions and a discharge certificate M.P.C. 43 in triplicate is prepared. One copy is given to the patient as evidence of hospital treatment in any claim he may make for compensation. The duplicate of this, on which the patient acknowledges the receipt of the original, is attached to the hospital case sheets and forwarded to the Casualty Records Office, and the third copy is left in the hospital file.

THE MEDICAL HISTORY OF EACH SOLDIER.

The fourth important duty of a statistical nature is to compile an accurate medical history of each soldier while he is serving in the Army. This is done on A.F. B-178, the medical history sheet, a very important document which should move with the soldier wherever and whenever he moves, except when he goes on active service overseas. It is normally kept in the Medical Inspection room by the M.O. i/c unit whose job it is to keep it up to date. It must be sent to hospital (except E.M.S. hospitals and Civil Infections hospitals) as soon as the man is admitted. When the man proceeds overseas on active service it is sent to his Officer i/c Records to be retained with his other documents. It is made out in the first instance when the man is medically examined on enlistment or when joining up for service. It gives a medical description of the man with reference to certain Army standards. Chest measurements, height, weight, eyesight, etc., and any minor defects detected on preliminary examination should be noted, such as varicocele, varicose veins, scars, hammer toes, flat foot, etc., as these may have an important bearing should the man come up for medical boarding at a later date. In preparing board papers, the medical history sheet should always be looked at for any such entries.

In the middle of the form are entered records of all admissions to hospital. It is most essential that these records should be short, concise and strictly relevant. The important details are name of hospital, dates of admission and discharge and number of days under treatment, diagnosis and probable cause, e.g. constitutional or trauma or infection, etc. If the admission was due to an accident you should state if A.F. B-117 has been rendered; then very short notes as to the illness or injury. These notes should rarely be more than three or four lines and not like A.F. I-1220 or Case Sheet A.F. I-1237. Treatment, progress and result are the important details; whether cured or improved; whether operation performed, splints, plaster, X-ray or not; findings of examination of sputum, fæces, urine, blood if relevant, but not if results negative or of no importance.

Other details that have to be recorded on A.F. B-178 are records of blood transfusions; records of all inoculations and vaccinations; dental condition and treatment; prescription for spectacles; medical boards; Courts of Enquiry on injuries; regrading of category on leaving hospital.

THE SAFEGUARDING OF THE STATE AND THE INDIVIDUAL.

The fifth and sixth principles or purposes for which accurate records must be kept are closely allied, namely the safeguarding the State from undue additions to the pensions bill, undue wastage of manpower on medical grounds, and to compensate the individual soldier for disability attributable to or aggravated by his military service.

The two important Army forms connected therewith are A.F. B-117, report on injuries (other than wounds received in action) and A.F. B-179, medical report on a soldier (for officers A.F. A-45).

A.F. B-117 is designed to record two important facts with regard to any injury however trivial: (1) Did it occur on duty? (2) Was anyone else to blame? These records are necessary to enable the Ministry of Pensions to decide on any subsequent claims that may be put forward by a soldier. These two facts are decided by the man's C.O. as far as possible. The M.O. is required to state the nature of the injury, whether trivial or serious and whether likely to interfere with his future efficiency. This is asking for a prognosis at a very early stage when it is not always possible to give an accurate one, but such a prognosis need not be accurate and is only required to determine whether the injury is serious enough to require further investigation. If the injury is stated by the M.O. to be serious or likely to interfere with his efficiency, then a Court of Enquiry is held under the orders of the man's C.O. Apart from establishing those two facts, whether on duty or whether there is anyone to blame, this Army form is not concerned with the ultimate progress or eventual result of the injury. On completion it is sent to the man's Officer i/c Records and retained there for future reference. In the case of officers it is sent to the War Office.

The second Army form connected with recording the attributability or otherwise of injuries or disabilities is A.F. B-179, medical report on a soldier (for officers A.F. A-45). This is the bugbear of all O.C.s hospital and A.D.M.S.s alike, not to mention such lesser lights as officers in charge divisions and even ward medical officers. Medical boarding bristles with difficulties but, if certain fundamental principles are grasped and kept in mind, these difficulties become minimized.

First of all you must remember that these board papers are finally scrutinized by the Ministry of Pensions who are not concerned with elaborate histories, with a concise symptomatology from A to Z, nor a carefully taken case sheet from a professional standard filled with a number of negative records and obtruse tests that may or may not be relevant to the final issue. In this respect A.F. B-179 is exactly the opposite of a well-written case sheet—A.F. I-1237. So consider first what details the Ministry of Pensions do want to know. Briefly they are as follows:

- (1) That the man who is applying or may subsequently apply for a pension is the man whose disability is recorded on A.F. B-179.
- (2) That the disability described is the one for which he is claiming a pension.

- (3) That any other disabilities claimed or discovered do or do not affect his efficiency.
- (4) Whether the disability or disabilities were attributable to or aggravated by military service.

First of these then is that the Ministry of Pensions can be sure that the man applying for or drawing a pension is the man who was boarded on A.F. B-179. To this end great accuracy is necessary in recording the man's number, surname and christian names, also the signing by the man and witnessing of his signature in Part 2. It is astonishing how many men there are in the Army with the same surname and combination of christian names. It is equally astonishing how frequently wrong regimental numbers are recorded. The only way to get accuracy is to check all these details with the man himself verbally. Never copy them from the A.F. I-1202 (diet sheet) or A.F. I-1220 (case card), which are filled in by a clerk in the hospital record office from details taken on admission in the reception room and are frequently incorrect.

The second guiding factor required by the Ministry of Pensions, is "for what was the man invalided?" We must be perfectly definite in this. Practically every man has some minor malady—perhaps a hammer toe, or flat feet, varicose veins, varicocele or slightly defective hearing, etc., but unless these would be or are causes for invaliding they should not be mentioned unless they occurred as a result of service. If, on the other hand, there are two or more disabilities both or all of which are sufficient causes for invaliding or which might have been caused or aggravated by service, then they must be mentioned and numbered throughout the form so that the answer to questions on the form shows clearly to which disability they refer.

All diagnoses must be in accordance with the Nomenclature of Diseases.

Once having arrived at a definite diagnosis, the answers to the questions should be strictly relevant to that or those disabilities. For example, it is useless to make a diagnosis of dyspepsia followed by a strong history of T.B.; then, in the present condition, bring out a weak statement showing vague symptoms of dyspepsia with no report of the effect of treatment; then an X-ray report showing indications of a chronic bronchitis or fibrosis and then a Psychiatrist's report showing psychopathic personality. Such a case came before me recently. As another example, in a case discharged as *pes planus*, in the history reference was made mainly to arthritis and, in the "present condition" reference to a possible gonorrhœa and a doubtful positive complement fixation test. These facts would be all right if they established a definite decision or diagnosis but they only throw doubt on the nature of the disability or bias the opinion of anyone perusing the report at a later date and the whole object of the form is thwarted, namely to fix the degree of attributability of the disability to Army life.

Thirdly, to record whether any other disabilities claimed or discovered do or do not affect the soldier's efficiency. If they do affect his efficiency then they have to be dealt with as described above. If they do not affect the man's

efficiency, they should be noted and a statement made whether they are actually observed or whether they have been complained of by the man himself and that they have had no bearing on his efficiency as a soldier. Such disabilities must on no account be mentioned unless such statements are added.

The fourth object to be attained in completing A.F. B-179 is to aid the Ministry of Pensions in deciding the attributability, or degree of aggravation by service of the disability. The important factors to bring out are the man's own statement, his previous service, if he ever served in any other of the Services and if he was ever invalided from it, and his work before he joined the Army. One quite often finds that a man claiming that his chronic bronchitis was caused by a drenching at Dunkirk or night guards in France was many years ago invalided from the Navy for T.B. or had been a coal-miner or steel worker before enlistment. X-ray reports would be essential in such cases.

Under history and present condition, notes must be short, very concise and absolutely relevant and they must give a very definite picture of why the man is unfit for service and must establish the diagnosis. The first sign or symptom mentioned should be the most important one, e.g. in T.B. cases either sputum if positive or X-ray report if definite; in malaria, the blood examination; in dysentery, the stools examination; in arthritis, X-ray examination, size of joint, limitation or otherwise of movement. Full details of analysis of urine or gastric fluid unless conclusively pathognomonic or relevant to the case should not be given but only referred to at the end as "urine and gastric fluid nil abnormal." In gastric cases, under present conditions, don't give first of all negative details such as "no vomiting," "physique good," and a full test meal analysis with nothing symptomatic, and then, at the end of this description, barium meal X-ray shows "Ulcer of 1st part of duodenum"—Put the last definite information first. It is bad case taking but it is good recording. In this respect the notes on A.F. B-179 differ markedly from those on a Case Sheet A.F. I-1237 or civilian case card which should, of course, be comprehensive.

In all cases the effect of treatment should be stated, e.g. arthritis, treatment with salicylates, radiant heat or infra-red rays gave no improvement; in chronic gastritis that careful dieting and treatment with sedatives did not cure the condition; in chronic malaria, that prolonged treatment with quinine, atabrin, plasmoquine, etc., did not effect a cure or prevent relapses.

So much for the most important documents with which you have to deal. There are three other less important ones which nevertheless should be done carefully and thoroughly. These are the Case Sheet, A.F. I-1237, the diet sheet A.F. I-1202 and the Transfer Certificate A.B. 172. One need say very little about these.

First, the Case Sheet. This form is not made out for every patient admitted to hospital but only for cases of professional interest and serious illness and such others as are likely to be required for future reference; also

for patients transferred to another hospital. When a patient is admitted who is obviously very ill a case sheet should be started as soon as possible and kept up with daily entries. It frequently happens that a patient dies and the case sheet is made out afterwards from memory with only scanty, if any, record of condition on admission, progress of the disease leading up to death and details of treatment given.

The important details required on A.F. I-1237 are accurate details of the man's name, service, age, unit and station; date of admission and date of first entry on the case sheet. One's first entry should be signed by the officer making it. It is remarkable how often one sees a case sheet with no note of station and date of admission or date of first examination. When cases are handed over from one officer to another the case sheets should be signed by each with date—case handed over—case taken over.

It is advisable, though not imperative, that all officer patients have case sheets made out for them.

These forms are filed and retained in the hospital, usually for two years. They constitute the only record retained in the hospital of the illness of any particular patient and sometimes, when complaints of claims against the Government or medical service are raised at some subsequent date, a War Office demand on the hospital for a full report can only be met or answered if a case sheet has been made out.

In the case of death, the case sheet and other medical records, such as temperature charts, laboratory and X-ray reports, etc., are sent to the A.D.M.S. and D.D.M.S. for perusal and return.

Cases of typhoid and paratyphoid have a special form of case sheet made out and venereal cases all have venereal disease case cards A.F. I-1247 (these are in addition to A.F. I-1220). The instructions for maintaining and disposal of these are laid down in Regulations for the Medical Services of the Army, Appendix 12.

With regard to A.F. I-1202—the diet sheet. The important things here to remember are that it is the only document other than the temperature chart, and not always that, which is kept at the man's bedside. It is an important label, apart from its dietetic purpose. It should therefore have correct details of the patient's name, length of service, unit, date of admission to hospital; then, in the margin, notes for the sister in charge of the ward such as hours allowed up, whether he can be used for light duties, and under present war conditions a distinctive sign as to whether he can go as a sitting patient to the shelter in case of enemy air action. It should be remembered, too, that medical officers are responsible for the dieting of patients and should not permit sisters to do this or make alterations without their knowledge or advice. Further, the A.F. I-1202 is a bedside label by which the man's diagnosis is readily available when required by divisional officer, wardmaster or statistical office. For this reason diagnoses when made should be recorded on the diet sheet as soon as possible, unless there is any special reason why the patient should not know it. Any changes of

diagnosis should similarly be recorded as soon as possible. A fresh diet sheet is made out for each month, the month dating from the day after the last Friday in each calendar month, up to and including the last Friday in the following month.

Diet sheets are filed in the hospital but may be called for at any time for checking and perusal by the D.D.M.S. or by Officer i/c Supplies or by the War Office.

The last of these forms to be referred to is A.B. 172. This must go with the patient when transferred to another hospital or convalescent hospital. It must show all the patient's particulars and his diagnosis. It is also important for the medical officer to enter on the form the patient's diet, his treatment, if any, that he is still undergoing or needs, and whether up or bed patient.

That concludes all that need be said about these troublesome Army forms—there are others, of course, but these are the ones that practically all medical officers, sooner or later, have to deal with, and if you can only master the fundamental principles on which they are based and the objects to be gained by their completion, then your paper work will become much easier and a great deal of time and trouble be saved throughout the channels by which these documents have to pass to reach their final destinations and before they are finally disposed of. One other bit of advice—don't leave your paper work to the end of your day's work—make good use of that hour in the morning before your wards or your departments, as the case may be, are ready for you—papers and documents 9-10 a.m.; ward 10 a.m., a first quick round to relieve the sister and ward staff to get on with their duties, then take your new cases, see your out-patients or whatever other work you may have. If you leave your papers till the end of the day or till the middle of the morning, they will become rushed and carelessly done, or perhaps you will become irritated as many have done at what those who do not understand the importance of them call Army red tape.

TREATMENT OF FIBROSITIS BY LOCAL INJECTION.

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MYOSITIS, fibrositis or muscular rheumatism may be manifest in various skeletal structures and the pain and disability produced are familiar to everyone. Whatever the nomenclature, the condition under discussion is usually easy to recognize clinically and should rarely be confused with more serious diseases. This is especially so now that there is a simple method of treatment which is applicable to a high percentage of cases and which is usually so rapidly efficacious that only those patients who fail to respond need be subjected to a more detailed examination. This method facilitates the management of large numbers of out-patients and also helps to minimize the number of mis-diagnosed cases.

The purpose of this paper is to describe the type of case suitable for treatment by local injection together with details of technique. Whilst working in a busy Military Hospital during the first winter of the present war a large number of such cases was seen and opportunity given to treat over one hundred men in this way. The results were highly satisfactory. Much pain and time off duty were saved as well as many hours of work by the Physiotherapeutic Department to which such patients are customarily referred. The method is not new and has been in use for several years but it is clear that its application is not sufficiently well known. It was found that a majority of medical officers and specialists were unaware of its efficacy and scope and all were interested to find that this common and troublesome complaint could often be cured in minutes instead of days, weeks or even months. There are comparatively few occasions when a physician is privileged to produce dramatic cure and earn the gratitude of patients who are relieved of distressing pain unexpectedly and rapidly. These notes are written in the hope of diminishing pain, incapacity and time off work in the winter. A man with fibrositis is temporarily a passenger in his unit.

Opinions and technique are based purely on personal experience. Owing to the exigencies of service it is impossible to consult the literature or quote references.

PATHOLOGY AND ÆTIOLOGY.

It is not intended to attempt an evaluation of the various theories as to the exact nature of the fibrositic lesion or the evidence on which they are based. It is difficult to visualize the pathology of a condition which may come on well nigh instantaneously and which in many instances may be permanently cured almost as rapidly. True rheumatic fever and neuritis are not under discussion though sometimes there may be an associated fibrositis which will be benefited by local injection. Neuritis implies

inflammation along some part of the course of a nerve and in these cases there is no evidence that such exists.

Neuritis can usually be recognized clinically and requires a different method of treatment, though here again local infiltration into or near the nerve sheath may cause temporary and sometimes marked relief or even cure. Opportunities for histological study are rare, although attempts have been made to obtain tissue for section and microscopical examination by means of a punch. There has been no agreement regarding the histopathology of the lesion and the truth is that its precise nature is still uncertain. Fibrositic changes which have been described may be from long standing cases and represent pathological sequelæ which could presumably have been prevented by earlier or more effective treatment.

It is difficult to assess the part played by infection. There may be no obvious focus and a seemingly healthy individual is attacked. The individual may have had a recent sore throat or influenza attack. Sometimes, especially with recurrent cases, a definite focus can be found. This is most often in the teeth, in the form of apical abscess or chronic marginal infection, or in the throat. Less commonly it lies in a nasal sinus and rarely in prostate or cervix. Suitable treatment will prevent recurrence of fibrositis and there is no doubt about the marked improvement which sometimes occurs.

Fibrositis is especially common in those who are rheumatic subjects constitutionally and often by inheritance. Exposure, chill and a general lowering of resistance from any cause all play their part. Probably some degree of infection is always a factor but it may be difficult to demonstrate. Trauma is a precipitating factor in other cases as exemplified by the patient who is seized with acute pain in the back whilst bending down or lifting a weight.

The recent experimental work of Lewis and Kellgren is important and instructive. Using some irritant solution such as hypertonic saline they have been able to reproduce a type of pain identical with that of patients suffering from fibrositis of the kind described in this paper and to relieve it in the same way. They have been able to map out areas of referred pain and show how this varies with a superficial or deep lesion. Moreover localization is more accurate with a superficial lesion and deeper ones are accompanied by characteristic though more diffuse referred pain.

Incidence.—There is no need to emphasize the frequency of this type of case in practice. It is, however, certain that many cases are mis-diagnosed. Fibrositis is rare in children and adolescents and increasingly common thereafter. It occurs in both sexes and especially in those in whom physical strain is likely to be a precipitating factor. It occurs most frequently during the winter months and especially between Christmas and spring.

Manifestations.—The chief symptom is pain and the chief sign is localized tenderness. The onset is usually sudden or rapid. Occasionally pain comes on gradually and then gets worse but, even in these cases, it may be after several months, the patient can often remember when it began to

within a day or so. The pain may be agonizing in severity and movement may be restricted to a minimum from resultant reflex muscle spasm. Everyone is familiar with the individual who bends down to pick something off the floor or strains his back in any way and is seized with such pain that he can scarcely get up again. Fortunately these people are the easiest to cure. Sometimes the pain is less severe or may only occur with certain movements, thereby putting the affected tissue on the stretch, and the patient can continue with his business without treatment other than home remedies. Tenderness is usually localized to one area by the patient and frequently with careful palpation exact localization can be made. Sometimes it is diffuse, e.g. across the small of the back, and such cases are harder to cure rapidly and rarely suitable for injection treatment. Radiation down the course of a nerve in one limb is common and will be discussed under the various regions concerned. Such cases usually respond especially well if pressure over the point of maximum tenderness reproduces the radiation.

There may be a general feeling of malaise, sometimes with headache, dizziness and nausea and the patient is grateful for being assured that these general symptoms are only a harmless accompaniment of his rheumatism and will also disappear with a successful local treatment.

A localized area of fibrositis in muscle may closely stimulate visceral disease as explained below. Pain may have been present for weeks or months but length of history is of little moment apart from any secondary effects which may have been produced.

Diagnosis and Treatment.—Accurate diagnosis is essential for successful treatment. The presence of fibrositis and the absence of other conditions may be suspected from the history and confirmed by physical examination. Rapid onset of pain of a type which the patient may describe as rheumatism or neuritis is frequently such that it does not suggest anything more serious to the physician. If examination does not arouse doubts careful palpation in the region complained about should be continued with the object of discovering whether a typical fibrositic lesion can be found. It is not proposed to discuss the differential diagnosis in any detail. Experience and care will minimize difficulty in recognizing fibrositis and the test of response to treatment is the natural corollary to diagnosis. If fibrositis is excluded or fails to be relieved by treatment then the position must be reviewed and supplementary methods of examination may be necessary.

It is not always easy to be certain that the lesion is not a traumatic one because some form of strain may precipitate an attack of fibrositis and a similar history with acute pain in, for example, the back, shoulder or intercostal region may give very similar physical signs. Moreover identical treatment by injection will usually relieve either condition. There may be a similar basis in the causation of the actual pain whatever the actual lesion is. On the whole in a true sprain there is a history of more definite trauma and the pain tends to recur when the local injection wears off although it helps recovery markedly.

In cases of more gradual onset there may be difficulty in differentiating the various causes of pain, e.g. in chronic backache, but it is certain that many such patients in whom no satisfactory cause can be found are relieved to a varying extent by the method of treatment to be described. Sometimes a typical fibrositic area may be found whilst examining a patient for some other disease and it is a relief to find a more simple explanation and moreover something more easy to treat. In doubtful cases it is justifiable to confirm or exclude a diagnosis of fibrositis by testing the response to treatment. Further useful information can be obtained in a few minutes and with due care no risk is entailed. It cannot be over emphasized that the area to be injected should be accurately localized or treatment will be disappointing.

The point of maximal tenderness must be found and is usually confined to the area covered by a finger tip. There may be two and rarely more such points and it is best to mark them with a skin pencil or fountain pen. It is also advisable, when they have been found, to keep the patient in that position until the injections are given because if he moves it is sometimes difficult to find them again. Prolonged and patient palpation may be required, especially in the gluteal region, and with the patient in different positions. Localization may be aided by putting the various muscles, ligaments or fasciæ on the stretch when pain will be at once elicited if the lesion is situated in that tissue. Sometimes moving a limb or part of the body into a different position will uncover the lesion and make it more easy of access to the palpating finger. Very firm pressure may be needed. The patient should be told how to co-operate and it is explained that he will not be relieved of his pain unless one finds the exact spot. The pain is usually such that he is only too anxious to help and if it cannot be found and one feels reasonably sure of its existence he can be told to try and find the place himself and return later. He is then reassured and told that he will feel an initial small, sharp prick and nothing further unless the exact spot is found, but if this can be found the pain can be relieved in a few seconds. If one has really localized the lesion this confident assertion is quite justifiable. In doubtful cases it is best to say that some relief can be given anyway and possibly all the pain will go away. A wheal is then raised with 1 per cent procaine and the finest hypodermic needle attached to a 2 c.c. syringe. A larger and longer needle is then attached (No. 12 is suitable) and gently pushed on through the wheal until the actual lesion is struck. The patient will have no difficulty in recognizing this as it causes a sharp pain which he usually realizes is the "right spot" and if there has been previous radiation, this will be reproduced. The plunger is pressed home at once with immediate relief. The syringe is then detached and a further 2 c.c. injected. If the exact spot is not picked up the needle should be gently inserted in a slightly different direction. If one feels sure one is near but cannot actually strike the lesion it is worth while inserting about 10 c.c. and massaging it round in the hope of causing some relief, but this is rarely complete and the

procedure is less satisfying. The patient should be told to work off his stiffness during the next few hours, take two aspirins or Tab. A.P.C.c. codeine on going to bed, and return in two days' time if not cured. There is nothing to be gained by using a stronger solution of procaine. The addition of adrenalin to the solution, which is sometimes advised, is not indicated. There is no reason to localize or delay the action of the procaine and the occasional after-effects are undesirable.

There should be no danger of sepsis and in hundreds of cases it has never once been experienced. There is no need to sterilize the skin. Soap and water cleansing is adequate. Iodine applied immediately before has no sterilizing action but is useful for marking the spot. Provided that contamination is avoided and care taken not to touch the needle all that is required is a sterile syringe, solution, and needle. There is no need to wash up or use gloves.

If there is a subsequent return of pain the injection may have to be repeated on a second or even a third occasion. This is most usual in long standing cases and is presumably due to the lesion not having been completely abolished so that the mechanism for producing the referred pain is still operative. An aching sensation in the affected part may be present for a few hours.

The customary treatment for fibrositis is some form of heat and deep massage. The combination of infra-red radiation and massage is possibly still the best and simplest form of treatment for diffuse cases. I have no extensive experience of other methods of physiotherapy but they are often not readily available or only so in special clinics. Whereas this treatment was successful in about three weeks similar cases of localized fibrositis can now be treated equally successfully in a few minutes in at least a majority of cases and, in my experience, in about 90 per cent of accurately diagnosed cases with no functional element. Some patients, especially if relief from injection has only been partial, definitely need movement and exercises as well. A majority of cases of sciatica of more than a few days' standing need help from the massage department especially in the form of relaxation, the regaining of full movements and postural exercises, together with active exercises to develop muscles and regain tone. The loyal co-operation of the massage department, which is characteristic, is invaluable. Cases which were being treated on general lines have often been referred for injection when local tenderness has been discovered and these workers are expert in localization in difficult cases.

Fibrositis may occur in almost any region of the body but is most common in certain situations, notably in the lumbar and gluteal regions, frequently with referred pain down the leg; the shoulder girdle frequently with referred pain down the arm; and the intercostal spaces. A few characteristic regions will be discussed in more detail.

Lumbago and Sciatica.—Pain in the lower back is particularly common and occurs in three chief areas—in the erector spinæ; the gluteal region

of one side, giving rise to unilateral pain ; or in the interspinous ligaments, giving rise to pain on both sides. Pain will be exaggerated by putting the muscle in question (or some point in the fascia) on the stretch or by flexing the spine. Cases occur where pain and tenderness are diffuse across the back and they are rarely cured rapidly or by injection. Diffuse large injections (10 to 20 c.c.) in the area may give partial or temporary relief but in my experience infra-red radiation with or without massage, rest in bed, hot baths, hot bottles, fluids and aspirin are more efficacious. Pain in the lumbar region is frequently referred in the distribution of one sciatic nerve and pressure over the fibrositic area in the back will cause such radiation. If the pain in the leg is severe the patient may not mention his back at all or may state that it started in the back and then went down the leg. Now and again pain localized in the outer side of the calf will be found to be due to a fibrositic lesion in the back and can only be cured by injections in the back. There is no true sciatic neuritis in these cases and there is no pain on stretching the nerve. There may be a false lasègue sign (limitation of straight-knee hip flexion) in that pain is caused by putting the erector spinæ or glutei on the stretch. If care is taken to avoid this it will be found that stretching the sciatic nerve (e.g. by a straight-knee ankle dorsiflexion) does not cause pain. The ankle-jerk is normal and the neck flexion sign negative and there is no wasting. It is not intended to discuss the diagnosis or treatment of sciatic neuritis here. Suffice it to say that a majority at least of cases of sciatic pain are due to referred pain in the distribution of this nerve from a fibrositic focus elsewhere and such cases can be cured rapidly.

Shoulder Region.—Pain in the shoulder, often with radiation down the arm, may come from a variety of causes but in many cases a typical fibrositic lesion can be found if one knows where to look. There are particularly common areas over which local pressure will cause referred pain previously recognized by the patient. The points are surprisingly constant and can be picked up by experience. They occur chiefly in the region above the spine of the scapula and in the deltoid. These cases are usually diagnosed as brachial neuritis which they closely simulate. True neuritis will show tenderness over some very localized tender points in neighbouring tissues and there will be acute pain (which is absent in fibrositic cases) on putting the plexus on the stretch. True neuritis is much harder to treat.

Elbow Region.—Many cases of "Tennis elbow" can be cured by injection at the point of maximal tenderness followed by gentle full-range movements.

Intercostal.—Pleurodynia used to be a familiar diagnosis in patients with acute pain in the side of the chest made worse on movement but unaccompanied by cough or any present or subsequent evidence of pleurisy. There is no doubt that many of these are cases of intercostal fibrositis. The tender point (often with some radiation round the chest) can be easily picked up and injected with immediate relief. Now and again a second

injection is necessary to remove a little remaining pain. Exact localization is essential for an area of less tenderness along the course of the intercostal nerve may be present. Penetration of the pleura should be avoided.

Incidentally, I have treated two patients with effort syndrome who were seriously distressed by the not uncommon stabbing pain in the region of the apex of the heart. A point of definite localized tenderness was injected and the relief experienced was surprising. This is presumably similar to the relief which can often be obtained in patients with angina not of the effort or coronary disease type (pseudo angina or angina innocens of Bourne), but accompanied by præcordial tenderness.

Neck.—Fibrositis may occur in the neck either as the familiar "stiff neck" with diffuse tenderness which passes off in a few days or with local tenderness. The cases are not always sharply defined but the more the localization, the greater will be the relief from local injection. Care must be taken to avoid important structures with the needle.

An officer, aged 28, was referred owing to a peculiar grating feeling he had experienced on movement in the upper part of his neck for two or three weeks, accompanied by slight pain and a feeling of fuzziness in the head and slight malaise. His cervical spine had been X-rayed and no abnormality seen. Careful palpation revealed two very localized areas one on either side of the mid-line (and about half an inch away) situated in the deep muscles of the upper part of the neck. The tenderness was more marked on one side. After a few minutes of gentle probing each of these was picked up with the point of a fine needle about an inch from the surface and giving rise to momentary acute pain. Injection caused immediate relief much to the astonishment of the patient and the grating feeling disappeared. He wrote three weeks later to say that the pain and grating had returned in a minor degree the next day but three days later disappeared and there had been no recurrence.

Simulation to Visceral Disease.—In certain structures, particularly the erector spinæ and rectus abdominalis muscles, a fibrositic lesion may simulate disease of some internal viscus, e.g. appendicitis, cholecystitis or renal colic. Harman and Young described twenty-four such cases in the *Lancet* of June 22 of last year. There is no need to emphasize the importance here of accurate diagnosis which may save radiography or operation.

One case will be described of a patient seen about a year before the war. A woman, aged 45, was sent for an opinion with a provisional diagnosis of acute cholecystitis. She had moreover been unwisely told that an operation would probably be needed sooner or later. The history was of rapid onset of severe pain under the right costal margin. There had been no similar attacks previously and she had an indefinite history of mild flatulent dyspepsia such as is common in a somewhat overweight menopausal woman. Palpation revealed marked tenderness in the right hypochondrium and she was reluctant to undergo any firm pressure. However once confidence had been gained careful examination revealed acute tenderness over a small region about one inch below the ribs and not in the exact position of the gall-bladder. By keeping a firm finger over this place and putting the recti into contraction the source of the pain could be exactly localized. Infiltration with 1 per cent procaine produced dramatic relief and there was no recurrence, though she had slight tenderness for a few days.

An extended history disclosed that one week before she had had a gumboil which resolved itself. She was accordingly sent to have the offending tooth removed.

Predominant Functional Element.—Many patients were referred for treatment who did not give a convincing history and in whom physical signs were also unconvincing. In these individuals it is most important not to give the impression that one is looking for localized tenderness.

Lumbago and sciatica (volunteered by the patient) are commonest in this group and, as always, it is difficult to refute someone who claims to have pain and one must be most careful not to be biased and miss organic disease. Suspicion may first be aroused, or it may be confirmatory to suspicions already formulated, when an area that "ought" to be relieved by injection of procaine is either not so relieved or is immediately aggravated. True fibrositis is invariably relieved temporarily at least though it is true that in a few cases the pain returns within a few hours, or next day, and may seem to be worse for a short time or require a second injection. It should be an invariable rule of the physician not to harangue the patient or abandon the situation or to give some placebo but to pursue the matter further himself or, at any rate, refer the patient to someone who will and, if necessary, to a psychologist. This means, in the first place, a realization that it is the man rather than the disease which requires treatment. Sympathy, patience, sincerity and understanding and the personality of the physician are all important. An extended history should be taken to include his adaptation to Army environment, past occupation, adolescence and education. Time and trouble are usually well repaid. Re-assurance, explanation and suggestion all play their part and simple psychotherapy on these lines is often all that is required.

Miscellaneous.—Local injection may provide partial though considerable relief in the treatment of tender areas round an arthritic joint. This is perhaps especially common round the knees in middle-aged or menopausal women and in the lumbar area of osteo-arthritic men.

Two cases of chronic tenosynovitis were referred to the clinic from the surgical side and rapid and permanent cure obtained with two treatments at two-day intervals in each case. It is essential for the solution to enter the tendon sheath and for the patient to practise full movements at once. The manner in which pain and the grating sensation disappeared was remarkable.

Experience has shown that a number of cases of backache, sciatica or "sacro-iliac strain" that an orthopædic surgeon would select to manipulate may be cured more easily and more pleasantly for the patient by injection. Sometimes it is best to try this method first and proceed to manipulation if it fails and sometimes the reverse procedure has worked successfully.

One patient was sitting on a chair preparatory to an injection into his erector spinæ and I flexed his lumbar spine in order to help localization of his pain. He immediately called out that something had "given way"

and his pain had disappeared instantaneously. Such a patient would, doubtless, have been cured equally dramatically by an intended manipulation.

Unsuccessful Cases.—If rapid and lasting cure is not obtained at once or after a few injections either the diagnosis or choice of suitable case is at fault, the technique is at fault, there is a focus of infection to be dealt with, or there is a predominant psychological factor.

SUMMARY AND CONCLUSIONS.

The treatment of fibrositis by local injection is simple and efficacious. This method is not advocated as a cure-all for any type of muscular pain. Suitable cases for injection treatment together with detailed technique are described.

A clinically similar condition resulting from trauma may be likewise rapidly relieved.

Accurate localization is essential for successful treatment.

The fibrositic area is one of marked local tenderness, often with referred pain on pressure, and both types of pain together with the physical signs resulting from muscle spasm are removed by the injection.

A RAPID AND CERTAIN CURE FOR MILIARIA RUBRA.

BY LIEUTENANT-COLONEL R. R. LEWIS,

Royal Army Medical Corps (Retired).

THE condition known as miliaria rubra, lichen tropicus, or, to give it its popular and most descriptive synonym, prickly heat, was lately recalled to my mind when turning out some old correspondence. I came across a letter from an Officer of the 1/East Surrey Regiment, sent to me when we were stationed together in Hong Kong during 1926.

This is what he wrote :

" I have been abroad for six years and each summer I have suffered agonies from prickly heat. In all I have tried twenty-nine so-called cures, recommended by various medical men; none of these did me any good until I tried your preparation. That was last year and I was cured in four days. This year my prickly heat returned and I tried your preparation again with the same marvellous effect."

After re-reading this letter, dated some fifteen years ago, it occurred to me that, as we have thousands of men serving in the East at present, a few words on this subject published in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS might be of service. For the benefit of those who have not yet served abroad, and indeed those who are now so serving but have not yet had an opportunity of using this simple method of dealing with a most annoying and painful condition, I will describe briefly its general characteristics.

Symptoms and Signs.—The appearance of a rash which when well established is accompanied by a burning sensation and intense itching.

Occurrence.—Chiefly occurs among Europeans in tropical and sub-tropical countries but mostly in localities where there is excessive humidity during certain periods of the year: Bombay, Calcutta, Colombo, Sierra Leone, Hong Kong, Malaya and other places where the temperature does not ordinarily rise above 95° F. but where there is roughly 100 per cent humidity. On the other hand certain individuals may be affected in perfectly dry heat where the temperature in the hot weather ranges between 120° and 130° F. This however is uncommon. Conversely some profuse sweaters in the humid climates are not affected at all. The reasons here are, I think, connected with individual idiosyncrasy and are only likely to be revealed by a microscopical examination of sections of skin from the individuals concerned. It is stated that negroes are never affected. This is undoubtedly true of the negro who wears next to no clothing. But the Haarlem negro, who dresses like the European, may possibly suffer from prickly heat during the terrific heat waves experienced in America, when, so I have been informed, there is a certain amount of competition, among

those who know how to get the entry, for a brief sojourn in the morgues, with the object of "cooling off."

Even in temperate climates it may occur in those who perspire very freely and have a tendency to seborrhœa.

The Rash.—This affection is characterized by the occurrence of innumerable minute red spots, varying in size from a pin's point to a pin's head with tiny central vesicles containing a turbid fluid. The spots are hardly elevated, and are not as a rule, follicular. They remain concrete and do not coalesce.

Area Affected.—The trunk and proximal segments of limbs are the sites of predilection; most commonly the front and back of the chest but distribution is governed by whichever area exhibits most activity on the part of the sweat glands.

Histology.—Congestion is noticed with the presence, in the rete malpighii, of minute vesicles formed either, as in impetigo, by cleavage or, as in eczema, by spongiosis. The vesicles contain numerous polymorphonuclear leucocytes and arise frequently, though not invariably, around a sweat duct. I note in the literature on this subject that one observer states that they are not due to dilatation of the ducts. The opposite view is taken by another observer who considers that a cystic dilatation of the sweat glands and ducts occurs due to the occlusion of the duct orifice. The latter view would seem to suggest that a condition had occurred where sweating was prevented. But in view of the fact that prickly heat occurs in those who sweat profusely I think the latter theory can be ruled out.

Ætiology.—The eruption occurs much more commonly in males than females. This may be due to the clothing factor. It comes on suddenly after profuse sweating, provoked by a rise of temperature, aggravated (so it has been stated) by the taking of hot alcoholic drinks though I cannot conceive why anyone should find it necessary in a tropical climate to take a hot alcoholic drink. A hot bath or violent exercise may cause the rash to appear. The vesicles may contain staphylococci (always present on the skin) in a state of active growth.

There is a theory that the eruption is due to an auto-inoculation of the skin with these organisms caused by maceration of the epidermis with sweat. The sweat glands themselves are not often infected with micro-organisms coming from outside, probably owing to the arrangement of the spiral (the gland itself consisting of a single or double convoluted tube) and the pressure of the sweat secretion. I am of opinion that the process is primarily physiological since two unvarying factors in causation are always present: (a) a hot humid climate and (b) a profuse sweater. One without the other will not produce the condition of prickly heat. So that it seems to me that the process, at all events in the earliest stages, is a mechanical one and not associated with organisms of any kind. Later, of course, one reaches a stage when, as the result of scratching and infection of the skin, septic sequelæ occur. Actually it has been noted that in many cases there is often

present an infective focus, a boil, impetigo, seborrhœic dermatitis, acne pustules, etc. But these in themselves have nothing, in my opinion, to do with prickly heat *per se*, and can only be regarded as the probable sources of the severe septic infections of the skin often noted to follow in its train.

Predisposing Causes.—(1) Wearing excessive clothing, more especially flannel, or any other material capable of causing irritation, next the skin. This is particularly noted in the case of infants. Too well clad, especially at nights, on account of motherly solicitude, they would make these nights less disturbing to fathers who have to "walk the floor" with them if their clothing consisted only of a napkin. Due regard should be paid otherwise to the measures necessary to prevent chill.

(2) Persons who are seborrhœic are stated to be more prone to the condition.

(3) Over-eating and consequent dyspepsia have been stated to be predisposing causes. I think this is of no importance.

(4) Abuse of alcohol. One would imagine that anything likely to cause congestion of the skin would tend to be a predisposing factor. Alcohol, taken in sufficient quantity, is stated to cause a lowering of the body surface temperature. As a regulator of temperature the skin acts chiefly by means of its sweat glands but these are under direct nervous control and not merely activated by an increase of the blood supply. This fact is proved by occurrence of a dry, hyperæmic skin in scarlatina and a moist anæmic one in collapse. The abuse of alcohol as a predisposing factor probably varies in different individuals but I do not think it is a factor of great importance. It has been stated that "the fat, plethoric European, who drinks a lot of cocktails in the Tropics, is the commonest victim." I would sooner put it that "the fat plethoric European in the Tropics, whether he drinks cocktails or not, is the commonest victim." But he *must* be a "sweater."

Treatment.—The literature on this subject has, so far as I know, never suggested anything specific. Various rules under the heading of "regimen" have been suggested.

Thus: Brisk purgation, then twenty-four hours' starvation. Copious drinks, barley water and fresh lemon juice, alkalies in large doses, tepid baths with zinc sulphate, boric and talc powder locally.

And further, to prevent recurrence, rational dietary (a good term in these days of rationing). Cut alcohol and take alkaline drinks. Use boric powder etc., etc.

The Club member who is used to his drinks at night is not likely to forgo them on account of prickly heat. And the medical man who prescribes this prophylactic treatment is not likely to find that his advice is being carried out or to gain any kudos for having advised it or indeed to be consulted further.

The numbers of suggested cures for prickly heat are legion. And within my experience none of them has been of the slightest use. So far as "regimen" is concerned, as outlined above, we can forget it with one

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main exception, the clothing factor. This should be as light as possible and anything causing the slightest irritation of the skin avoided. You can eat what you like or drink what you like or if you prefer it you can starve yourself but, given the type of climate and the sweating factor, you will get prickly heat just the same. Having a very sensitive skin, I had always been subject to it while serving in the Tropics or sub-Tropics, and I was never able to get any relief from the condition until I arrived in Hong Kong in 1923. There I found, in general use at the Military Hospital, a simple prescription, which usually resulted in complete cure in from forty-eight to seventy-two hours. One of its chief virtues was that, unlike the remedies which are beneficial to some and utterly useless to others, it cured everybody. A civilian friend of mine, who had been a chronic sufferer from this condition for years during each "hot weather" and who suddenly found that as a result of using this remedy he could keep himself completely exempt, offered to put up "big money" to advertise it throughout the East. This was a proposition which as a serving officer, I could not entertain.

Among other remedies or alleviants the ordinary dusting powder composed of zinc oxide, boric acid and starch has been recommended.

It is utterly useless.

But—add to it an equal quantity of sulphur sublimatum, the ordinary "flowers of sulphur," and you have the cure, i.e.:

R	Zinc oxide	} aa
	Boric acid	
	Starch	
	Sulphur sub.	

The ingredients should be thoroughly triturated in a mortar and then rubbed through a fine sieve in order to obtain complete admixture.

Affected parts should be sponged over with water and dried, the powder thereafter being dusted on with cotton-wool. Repeat the process on several occasions the first day and it will be found that it is not so frequently necessary on the second. Keep on applying it until the lesions have disappeared and at the first sign of recurrence use it again. One need never suffer from this often most distressing condition for long. It is especially valuable in the case of infants. I have never found a case which did not immediately respond to this treatment and I think this contention will be borne out by those who give it a trial. I mentioned the fact earlier on that there might be some who, serving in the Tropics, had not had an opportunity of using this simple remedy; in other words, who had not heard of it. This was because when serving in India in 1930 I found that no one with whom I came in contact appeared to be aware of it.

It has since occurred to me that it might be of benefit in other pruritic or non-pruritic conditions of the skin.

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Editorial.

THE ANNUAL REPORT OF THE SOUTH AFRICAN INSTITUTE FOR MEDICAL RESEARCH FOR THE YEAR ENDED DECEMBER 31, 1940.

It is fourteen years since we visited the South African Institute for the first time and we have never ceased to be profoundly interested in this centre of African research since then. At first sight the staff would seem to have been much changed in the interval; gone is the great personality which directed its endeavours—everyone then looked to Sir Spencer Lister for the next step—and gone are the two Pathologists whose efforts were so prominent in the domain of "silicosis," Mavrogordato and Pirie, though it is pleasant to think that these two, at least, are only gone from the printed list of the staff and that they are still present to play their parts in the work of the Institute if called upon to do so.

But a moment's study of the question shows that the staff has not changed more than must be the case with the flight of time and that, in all essentials, the South African Institute of to-day is still the "growing lad" that it was in 1927. Dr. E. H. Cluver, though then for the time being at Pretoria and engaged in the supervision of the hygiene of the Union, has only come back to the Institute as Director in the natural way of a well-deserved promotion and is now, in addition to his normal duties, the Professor of Preventive Medicine to the University of the Witwatersrand. His Deputy, Dr. G. Buchanan, was at the Institute then as now and has added to his obligations by becoming a Professor also with Clinical Pathology as his subject. We recognize, too, the same competent couple as before in Professor Sutherland Strachan and Dr. F. W. Simson who have wrestled so successfully with silicosis, tuberculosis and other pathological problems arising in the mines and elsewhere; Professor Becker, Dr. Grasset, Dr. des Ligneris and many others. The South African Institute then, is the same as always and is growing up to still greater proportions under able guidance and at the vast stimulus of a great war. We are glad to note that Mr. W. A. J. Cameron is still in charge of the general administration.

Though there are many things which might claim our attention in normal times we are bound to turn chiefly to the war effort just at present and we start with the provision, by the Institute, of two mobile field laboratories for presentation to the Department of Defence. This wonderful contribution was so much appreciated that the Institute was finally called on to raise three more and to equip additional laboratories for Military Hospitals of the South African Field Force. An arrangement was come to with the military authorities "to train for field laboratory work medical officers and

technicians posted to it by the South African Medical Corps." Six officers, all with previous laboratory experience, were trained during the year and two classes of technicians were put through as well; in fact the Institute appears to be making great headway as an advanced School for the purpose of instruction for the Corps. The Director, at the request of the Secretary of Defence, paid a personal visit to the Forces operating to the North and made valuable observations in connexion with the research on foodstuffs as well as seeing for himself the work being carried on by the mobile laboratories produced by the Institute and visiting the Carnegie Yellow Fever Laboratory at Entebbe, Uganda. From the latter visit came the invitation to Dr. G. M. Findlay of the Wellcome Research Institute to visit the Union to give further advice on the preparation there of Yellow Fever Vaccine.

Typhus is known to be prevalent in the North where the fighting is in progress and the services of Dr. J. H. S. Gear, now gazetted to the Service, have been devoted to the necessary research and cultivation of the Rickettsias needed for a suitable vaccine for protection of those exposed to the disease. He has also given ten courses of instruction in tropical medicine to medical officers training for duty in the North.

There are also researches on plague by Dr. Grasset, work on an Endotoxoid Vaccine for typhoid fever which has been sufficiently popular to lead to the issue, during 1940, of 900,000 doses from the Institute, a study of the anophelines in Portuguese East Africa by Dr. De Meillon and much work on venoms and their antivenenes by Drs. Grasset and Schaafsma during the past year.

Nutritional surveys were carried out by Drs. Fox and Back who found that a great deal of the malnutrition amongst the "poor whites" in rural areas was due to the grossly defective diets in common use, particularly because such diets were short of "defensive" substances.

Dr. M. J. A. des Ligneris has continued his studies of the cancer problem. He finds that he can produce as many as 80 per cent of skin cancers, some with metastases, by painting mice with extracts of cancerous Bantu liver. In two hundred cases of mice painted with non-cancerous European livers he has only produced one cancer, a sarcoma, which failed to produce any recurrence in other mice because of its contaminated condition. "As spontaneous skin tumours are practically non-existent in mice (though tumours of certain internal organs are of frequent occurrence) there can be little doubt that a cancer-producing agent is present in such Bantu liver extracts." Professor Cluver must be congratulated on a thoroughly readable Report and, especially, on the very great amount of original research undertaken by his Institute.

NOTE BY LIEUTENANT-COLONEL M. J. WHELTON, R.A.M.C.,
ON "MEDICAL WORK OF THE KNIGHTS HOSPITALLERS OF
ST. JOHN OF JERUSALEM."

THE publication in the eventful year 1940 in the United States of America of a history of the medical work of the Knights of St. John of Jerusalem, by Lieutenant-Colonel Edgar Erskine Hume, Medical Corps, United States Army, is of great interest to medical men all over the world but it is from members of the Royal Army Medical Corps that it merits a special welcome. Coming from the pen of a military medical officer and treating in extensive manner places well known to many officers in the Corps its perusal will evoke memories in many, interest in others, and in all a feeling of gratitude to a colleague in America who recounts in vivid style the salient events of its many vicissitudes, particularly those that occurred during the 267 years the Knights occupied Malta—a well-known place to many who have been stationed there and who have seen the many magnificent buildings built by the Knights which have survived and are still in use. Of much interest, too, is the account of the period during which Cyprus was occupied—many who have seen the imposing structures that still exist will read with renewed interest the full story of their construction.

Just now, when history is in the making, it may not be without benefit to read in this masterly production of the trials, hardships and difficulties which so often confronted the Knights and of the steadfast courage with which they opposed the Turks who endeavoured to overwhelm the Christian powers.

This work covers a long period of history. It is the first time the whole story has been published in the English language—so Colonel Hume, who has been librarian to the Surgeon-General's Library in Washington, carries on the tradition of erudition and authoritarian knowledge of medical history that has been associated with holders of that appointment. But it is more than a mere record of the medical work of the Knights. It reflects the spirit of the different ages and epochs of European history. It is a pageant of the great personages who played a part in the moulding of Europe. He has taken a large canvas, extensive in time, and has filled in the centuries with an account of the Order during its many vicissitudes; he has traced its development from a small beginning until it became a powerful military organization—of champions and uncompromising defenders of the Christian faith against the Moslems—virtually the Turkish Empire from the 14th century onwards, to whom were allied the different racial elements of the North African seaboard in a loose confederacy. The permanent results of the prolonged and sustained efforts of the Knights is little realized by the vast majority, so that this record, which contains much material collected from different sources, can be regarded as an excellent reference book on the subject.

As it is unlikely that many members of the Corps will have the opportunity at the present time of reading this work owing to war-time difficulties, it may not be out of place to give a short account of the history of the Knights and the events and developments which have taken place during their existence.

They have not always borne the same name—known as Hospitallers of Jerusalem from the time of origin in or about 1065 until 1309, as Knights of Rhodes, 1309 until 1522, and as Knights of Malta since 1530, Saint John the Baptist was adopted as their patron saint, so they are frequently referred to as Knights of St. John. The Order was founded by a monk, probably of Belgian nationality, a Brother Gerard, whose family name and exact birth-place it has not been possible to ascertain. This humanitarian monk opened a hospice in the vicinity of the Holy Sepulchre in Jerusalem, where poor and sick Christian pilgrims were accommodated. A visit to Jerusalem for those living in Western Europe was at this period a difficult and exhausting trial not without dangers. It is recorded that a bishop took seven years to journey from France to the Holy Land and return. Brother Gerard's hospice was intended for the sick more than for the poor. He gathered round him a group of workers who called themselves "the poor Brethren of the Hospital of St. John." In time more spacious buildings were erected and the hospice became an infirmary in the modern sense of the word. About this time, that is towards the end of the eleventh century, there was a religious stir throughout Europe which found expression in the preachings of Peter the Hermit, a recluse of Picardy, who voiced the burning desire of so many—that Jerusalem, the first city in Christendom, should be wrested from the Moslem power that held it. At a great concourse at Clermont Ferrand, in southern France, feudal lords and their retainers took solemn vows that they would endeavour to recapture the Holy Land, and the First Crusade was the outcome. The Crusaders journeyed via Constantinople and, encountering opposition all the way and in spite of unbelievable difficulties, about twenty thousand survived to storm and capture Jerusalem in 1099. One of their most sagacious leaders, Godfrey de Bouillon, a French Noble, was made, in accordance with the custom of the times, the first king of the newly formed state—the Latin Kingdom of Jerusalem. It is thought that Godfrey did everything possible to help Brother Gerard in his work. Papal recognition came in 1113 by the granting of a charter by Pope Pascal II wherein they were constituted into a regularly organized religious Order, the Knights of St. John or Hospitallers, with the eight-pointed cross, now known as the Maltese cross, as their emblem. Their dress was of dark cloth, and as the cross was of white material they were often referred to as the White Knights. They adopted the monastic rules of St. Augustine and had the usual vows of chastity, poverty and obedience.

The times were rough and it soon became apparent that all Christians capable of bearing arms should be available for the effective protection of the newly created kingdom. The Order became a semi-military organiza-

tion. Thereby was brought about the creation of a unique institution, the religious order of knighthood, thus combining the two aspirations of the Middle Ages, religious fervour and martial prowess. Their work during the existence of the Kingdom of Jerusalem—a little less than a hundred years—was of the utmost importance. According to a pilgrim in 1150 approximately 2,000 sick were cared for annually in the hospital in Jerusalem.

The kingdom was held by European nobles, who built castles in various parts of the country. Their ruins may still be seen in various parts of Palestine and Syria and they were garrisoned by their retainers brought from their own country. In the meantime the Moslems had been increasing in power and, under the leadership of that soldier of great ability, Saladin, the Christians were defeated at Hattin in 1187. The battlefield is on the high ground between Acre and the Sea of Galilee and was remarkable for the unhesitating way in which the Knights, whether of St. John or of the allied order which was purely a military order—the Templars—all accepted death in preference to renouncing their religion. It was a tragic day for Christian prowess and chivalry and was the turning point of the struggle between the contending religions. As a sequel to it, all the Crusader castles and cities in Palestine fell to the victorious Moslems. The factors leading up to these events and the ominous happenings are recorded with the impressive dignity they merit by Colonel Hume, who writes (p. 8): "The decline and fall of the Latin Kingdom of Jerusalem is a melancholy story with its picture of the jealousies between the Christian monarchs. The two military Orders, the Hospitallers and their rivals the Templars (founded about 1118 and so called because King Baldwin II of Jerusalem assigned them part of the area that had included King Solomon's Temple) showed unbroken loyalty to their ideals, but their heroic sacrifices and the death of so many of their Knights could not save the kingdom. Jerusalem was the Holy City to the Moham-medans as well as to the Jews and Christians, as the Sultan Saladin wrote to Richard Cœur de Lion, and this brave Saracen was at length able to achieve his ambition and recapture the city from the Christians after the battle of Tiberias on October 2, 1187. With rare mercy Saladin allowed the garrison of Jerusalem to march out with the honours of war, and he even permitted the Hospitallers to leave ten of their number in the city to care for their wounded until able to travel. The exodus from the city lasted forty days, the citizens leaving in three parties, the first conducted by the Templars, the second by the Hospitallers and the last by the Patriarch and Balian of Ibelin. Saladin provided an escort as far as the frontiers of the county of Tripolis."

Subsequent to this blow to Christendom the Hospitallers were able to get established in Margab in Syria, which country continued to remain within the sphere of influence of the Christian Knights subsequent to the loss of Palestine. However, they were able to return to the latter country when Acre was captured by Richard Cœur de Lion in 1191, where they established a hospital. Later that city became the centre of their power so that it

has been known as St. Jean d'Acre to this day. Cœur de Lion's crusade was not successful and the city was recaptured by Saladin. The Hospitallers, as always, fought with the utmost gallantry under Grand Master Villiers. The remnants escaped by sea and went to Cyprus, where they established a hospital.

It soon became obvious to the Order that sea power would be necessary if they were to retain their new home, and they responded to this necessity with characteristic zeal and energy by building, equipping and manning galleys to counter the corsairs. By their efforts the seas were made reasonably safe for those willing to risk a journey to the Holy Land. From such a beginning their power expanded until in time they were virtually the guardians of the Mediterranean. The corsairs learned that "the White Knights could fight as formidably on a galley's deck as from behind a fortress." Cyprus, however, did not prove a satisfactory haven and the Island of Rhodes became their next centre. That island they captured in 1306 under the leadership of Grand Master Villaret. From this time onward the Knights played an important rôle in the struggle against the Turks, who had become the acknowledged leaders of the Moslem world. From their island base they carried out raids and expeditions against them. This they did in addition to carrying out hospital work, for which they constructed a magnificent building, which has recently been restored by the Italians and is described as "a gem of ancient art."

While in Rhodes the Order underwent a process of evolution and adopted the system of internal organization that was followed during succeeding centuries. Its members were divided into the different group nationalities or langues as they were appropriately called. Of these there were eight altogether, and one of the supreme dignities of the Order was bestowed on each one: to Provence that of Grand Commander, to England that of Turcopolier (i.e. command of local levies), to Auvergne that of Marshal, to France Grand Hospitaller, to Italy Admiral, to Aragon Standard Bearer. The Grand Master might be elected from any of the langues; he exercised supreme authority through powers given by the council. Each langue was divided into priories—there were twenty-four in all—and these in turn were divided into commanderies, of which there were 656. The head of each commandery was bestowed according to seniority—to be eligible for such a command experience of three campaigns was a necessary qualification.

For over two hundred years their influence radiated from this island. They remained the bitter opponents to the Turks, who had become very powerful, both on land and sea. The struggle was ended for the time being by the capture of the island in 1522. The Knights, under Grand Master L'Isle Adam, put up a stubborn defence with the bravery habitually associated with their name. At the end of six months, after fighting against overwhelming odds, they capitulated. The survivors were permitted to sail to Italy, where they remained until 1530, when they went to Malta, which was ceded to them by Charles V of Spain. Thus it was that in 1530 "the squadron of the Knight

of St. John, flying their ancient banner—the white cross on a field of crimson—reached Malta."

The period in Malta is probably the best known. They erected many splendid buildings; the main hospital was completed in 1578; the great ward is described as "a stupendous piece of architectural skill. It is 503 feet long, 34 feet 10 inches wide and 30 feet 6 inches high—one of the greatest interiors in the world." Apparently the hospitals were run on enlightened lines. Each langue had its own auberge; many are still in existence, and some are in use for modern needs. The Castle of St. Angelo and the L'Isle Adam's fortifications still survive and may be useful in the present era.

The struggle with the Turks smouldered on and flamed up in 1565, when the Knights successfully withstood a determined and well-sustained attack—this heroic defence has covered them with "unsurpassable glory." At sea, too, they played a prominent part and were present at the battle of Lepanto, 1571—one of the decisive naval battles of the world—where their flagship was captured "with great slaughter." Subsequent to those defeats the Turks never recovered sufficiently to be a menace of any proportion.

About this period, that is to say towards the latter part of the sixteenth century, Europe began to develop into a mosaic of different nations, with different religions and a different outlook. The English langue was disestablished by King Henry VIII, was re-established by his daughter Queen Mary, only to be finally disestablished by Queen Elizabeth. The French langue was disestablished during the Revolution and Citizen General Napoleon, on the refusal by the Knights of his request "to water his fleet," laid siege to the island on June 10, 1798. It capitulated two days later, and on June 18, 1798, Grand Master von Hompesch, accompanied by sixteen of his Knights, went into exile. Thus ended their era of eventful occupation of the island—a period of 267 years.

With the loss of their island home, the Knights had no central organization from which to direct their affairs in a war-distracted Europe during the Napoleonic period. Grand Master von Hompesch, having renounced his leadership in 1799, it was conferred on Tsar Paul, who became its 72nd Grand Master. His leadership was of short duration, as he was assassinated in 1801 and the Romanoff dynasty refused to be further associated with mastership of the Knights. There was one more Grand Master, for the period 1803-05, but subsequent to that date the appointment lapsed until 1879, when it was revived.

During the nineteenth century the activities of the Knights gradually became associated with the activities of the various European countries; the members co-operated with the official medical services of the governments in which they lived. In the first world war it has been estimated that 800,000 sick and wounded were cared for by the several branches of the Hospitallers in the different warring countries. The Italian Knights placed four hospital trains and a number of hospitals at the disposal of their government.

The Order in England was, as already noted, disbanded by the Tudors,

but was revived as an independent Order by Queen Victoria in 1888, when a Royal Charter was granted. Since then branches have been established in all the different countries of the Empire. There is an ophthalmic hospital in Jerusalem which is run by the Order. In addition a subsection whose members are trained to render first aid has been built up—the St. John Ambulance Association.

This brief account of the Order gives some idea of its long history and of the ideals which have animated its members ever since its foundation nearly a thousand years ago. The Japanese have a saying which might be applied to a Knight: "He had the gentleness of a warrior." The ideal of renouncing all so as to serve "our lords the sick," and in addition a readiness to take up arms when required, was a welding of the ideals of Christianity with chivalry that is difficult to appreciate fully in this twentieth century.

It is difficult to give an adequate picture of the excellence of this work by Colonel Hume. The quotations from hospital regulations have an unexpected similarity to present-day ones; some of the extracts from old records are apt and illuminating—tramps who were catered for were found to be "great wasters and mighty burdensome." There are references to members who helped the American colonists in their War of Independence, which makes interesting reading for the author's countrymen. The book is well illustrated; there are 130 pictures, of which many are unique; they have been collected from a variety of sources—museums, art galleries and palaces—as well as photographs. Of outstanding interest is the frontispiece, which is a photograph of the sacred relic, the hand of John the Baptist taken from the original in the Royal Chapel, Belgrade; this has never before been reproduced.

The book is a reprint with additions of a series of articles published in the *Bulletin of the Institute of the History of Medicine*, Johns Hopkins University, Baltimore. Many of the Corps have met Colonel Hume. He was Commissioner of the American Red Cross in the Balkans during the last war. He was a delegate at the meeting of the International Congress of Military Medicine and Pharmacy held in London in 1929. Just a few months before the present war the Congress again met in Washington, where Colonel Hume was one of the hosts to delegates from a great number of nations whose armies are now engaged in a struggle that threatens to spread even further. These Congresses fostered the same ideals as the Knights—in a modernized form—the pooling of knowledge that might be of use in war. Alas! the war has come!

Clinical and other Notes.

"MATCH-BOX DERMATITIS."

BY MAJOR A. GIRDWOOD FERGUSON, M.B., CH.B., F.R.F.P.S.G.,
Royal Army Medical Corps.

THE list of substances which have been proved to be the cause of dermatitis venenata (sensitization dermatitis) is almost interminable. Idiosyncrasy to some substance or substances appears to be present in almost every individual.

An extremely interesting condition has been described by certain American and Danish workers, to which the name of "match-box dermatitis" has been aptly applied. A case of this nature has recently been observed at the out-patient clinic of a Scottish military hospital.

Case.—Corporal C. (aged 38). Reported for specialist opinion on June 3, 1941.

History.—Patient complained of a "rash" on the skin of the front of the left thigh which had been consistently present for the past two months, but which had remained localized to that part. Considerable itching and burning was present in the area of skin affected. A covering letter from his unit Medical Officer stated that the condition had proved intractable to all the medicaments which had so far been tried, most of which had either produced no appreciable effect or had appeared actually to aggravate the existing state of things.

Examination.—On examination, a roughly square patch of vesicular and papular eczematous nature, which measured 3 inches by 2 inches, was found to be present on the skin of the anterior aspect of the left thigh at the junction of its middle and lower thirds. The skin of the remainder of the body and limbs was healthy.

The eruption, while obviously due to action on the skin of the affected part of some external and irritant agency, did not clinically suggest dermatitis artefacta, which was at once considered owing to its localized nature and the unaffected character of the contiguous skin, nor was there any evidence of "habit-spasm" which might have placed it among the group of conditions known as neurotic excoriations. In the same way a localized patch of herpes zoster affecting the skin of the thigh was excluded by the absence of characteristic herpetic grouping of the lesions and of coincident neuritic pain in the part. The position of the affected area, moreover, now drew attention to the possibility of the causal agent being either constantly or intermittently present among the contents of the front patch-pocket of the battle-dress, which was noted to be situated immediately over this part of the thigh. On further questioning the patient, it was discovered that he habitually kept cigarettes and matches in this pocket.

Investigation and treatment.—Patient was instructed to remove his cigarettes to the breast-pocket of his uniform and to report in two weeks' time for further observation, using simple zinc paste once daily on the

affected skin during this period. On reporting for observation, the condition was found to be absolutely unchanged in appearance and character.

He was this time told to recommence carrying his cigarettes in the front pocket, but to carry his matches in the breast-pocket of his tunic. He was instructed to continue the local treatment and to report again in a further two weeks' time. On reporting, he stated that he had noticed considerable subjective and objective improvement in the condition. Examination of the thigh corroborated this fact, the patch having this time responded to the treatment and only a little pigmentation and residual parakeratosis being now evident. One week later he was again examined, when healing was found to be complete.

He was finally instructed to keep his matches in future in the breast-pocket of his service or battle-dress, where several thicknesses of material would intervene between box and skin, and to report any suspicious eruption immediately. He has since remained perfectly well.

There would appear to be little doubt that we are here dealing with a very typical case of this unusual disease, in which the primary factor has obviously been subclinical and cumulative sensitization of the skin of the thigh to some substance present in the matches or in their receptacle. Patch-testing was not carried out, and the exact nature of the offending agent was thus not determined, but it appears from the literature that this is usually phosphorus contained in the match-heads or in the striking-surface of the box.

It is interesting to note, also, that while treatment is usually as simple as in the present instance, some cases have been reported in which cure has not resulted following the removal of the local cause. It has apparently been at times actually necessary to put in new pockets, the material of the pocket itself having presumably become in such cases impregnated by the offending chemical and, in consequence, a continual source of trouble to the hypersensitive patient.

My thanks are due to Colonel D. F. Mackenzie, *D.S.O.*, and to Lieutenant-Colonel G. H. Haines, *M.C.*, *R.A.M.C.*, for their kindly encouragement and permission to forward this case for publication.

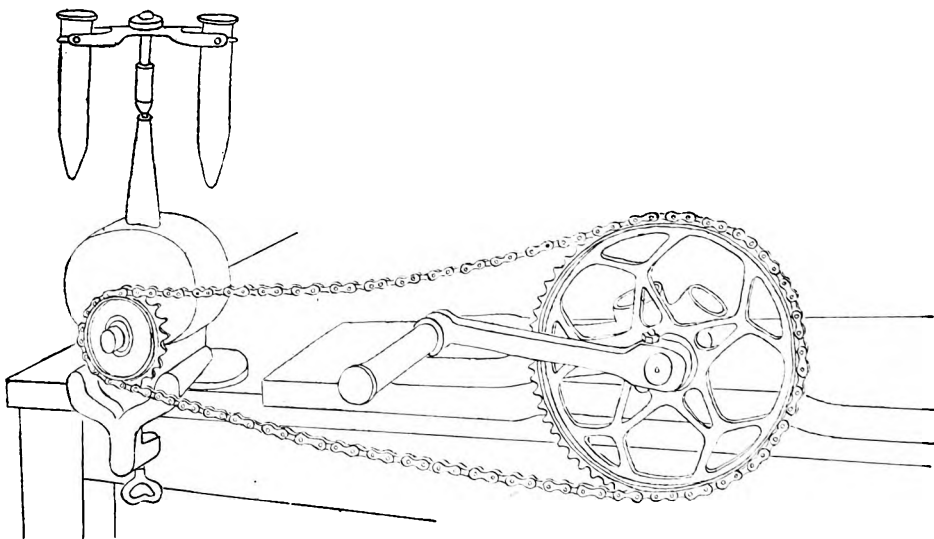
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AN APPARATUS FOR INCREASING THE SPEED OF THE HAND CENTRIFUGE.

BY CAPTAIN GEORGE H. SMITH,
Royal Army Medical Corps.

THE hand centrifuge supplied in the mobilization equipment of a 600-bed General Hospital, although suitable for obtaining urinary deposits, was found to be inadequate for separating the corpuscles from whole blood quickly. It was also found to be unsuitable for packing the corpuscles and for obtaining a good deposit of organisms from sputa treated by the antiformin technique. Sputa showing scanty acid-fast bacilli in the direct smears sometimes failed to grow tubercle bacilli on the Lowenstein-Jensen medium. It was suspected that the centrifuge was not fast enough to deposit sufficient organisms for cultural purposes.



It was only possible to spin a pathological material at a high enough speed to obtain a suitable deposit for about two minutes at a time and the process was very fatiguing and unreliable. A high speed therefore was only possible for very short periods.

In order to overcome this difficulty, an attempt was made to attach a geared drive to the centrifuge which would increase the speed and at the same time make the process easier. This was fortunately made easy as there was an old bicycle available. The free-wheel was removed completely from the rear wheel by means of a hack-saw, the wheel hub being included. The diameter of the spindle hole of the hub was greater than that of the driving spindle of the centrifuge, but this difficulty was overcome by finding a piece

of metal tubing which fitted tightly both into the free-wheel and on to the driving spindle of the centrifuge. A piece of this tubing about one and a half inches long was soldered into the spindle hole of the hub and the whole tapped firmly on to the driving spindle of the centrifuge.

The crank and bearing of the cycle was removed by sawing through the frame close to the crank bearing and through the rear fork about eight inches from the bearing. The right-hand crank and pedal was then removed. The crank and bearing was clamped on to the edge of the bench and the centrifuge adjusted to the correct distance and clamped firmly also. The chain was then adjusted.

It was found that the centrifuge could now be driven at a high speed by hand very easily and kept at a fairly high speed for a considerable time with little or no fatigue.

By means of the free-wheeling device, the centrifuge could be brought to a halt gradually and gently without the risk of a sudden jolt.

It is further suggested that an improvement could be made by utilizing a small electric motor to supply the driving power through the bicycle crank and chain.

I am indebted to Private McCormick, R.A.M.C., and Private Lawson, R.A.M.C., for their help in assembling this apparatus.

A diagram of the apparatus is shown.

Reviews.

MEDICAL ORGANIZATION AND SURGICAL PRACTICE IN AIR RAIDS. Second Edition. By P. H. Mitchiner, *C.B.E., T.D., D.L., M.D., M.S., F.R.C.S.*, and E. M. Cowell, *C.B., C.B.E., D.S.O., T.D., D.L., M.D., B.S., F.R.C.S.* London: J. & A. Churchill, Ltd. 1941. Pp. ix + 296. Price 12s. 6d.

To have run into a second edition two years after its birth indicates that this book has met with the success it deserves. The first 60 pages deal with the general management of air-raid casualties. It contains a good deal of interesting information and is completely up to date. The latter part covers the whole question, in principle and detail, of the treatment of the type of casualty most frequently met with.

The book is highly practical: redundancy in words is largely avoided (except possibly with Thomas's splint drill) and the descriptions and recommendations are clear and precise. The work is clearly the outcome of a very great practical experience and should continue to prove popular amongst medical officers both in the Forces and the E.M.S.

SCABIES—CIVIL AND MILITARY: ITS PREVALENCE, PREVENTION AND TREATMENT. By Reuben Friedman, M.D. New York: Froben Press 1941. Pp. 288. Price \$3.00.

Scabies has of recent times become so common that the devotion of a whole volume to it is, at the moment, particularly apposite.

In "Scabies, Civil and Military," Dr. Reuben Friedman divides the subject into four sections: civil, military, prevention and treatment.

In Section I he gives statistics for various countries and discusses the effects of age, sex, season, race and occupation. It is possible that what he has to say about asymptomatic scabies—silent carriers—may be the crux of the great problem with which we are faced to-day, the problem of how to reduce the incidence.

Section II deals with the military side and shows the effect of the infestation in the past on armies and navies and especially those of the U.S. That scabies is a very large Service problem, no one who reads this book can deny.

Section III is devoted to prevention, but only consists of some twenty pages and, in the light of research work now proceeding, it seems probable that many of the recommendations will need modification.

Section IV deals with treatment and all the time-honoured and some of the more recent methods are described and discussed. Complications occupy less than thirteen pages.

As a historical and statistical survey of the subject this book is in many ways excellent but, in the light of recent events, one cannot help feeling that the writer has just "missed the bus." The questions being asked nowadays are, Why is scabies increasing so rapidly? It is not due to the war because the rise began something like ten years ago. How is the disease spread? It seems probable that intimate personal contact is far more important than fomites. What is the life history of the parasite? This has never been properly worked out. How is scabies to be controlled when all time-honoured methods fail?

All who are interested in public health will do well to read this book where they will find much that is both instructive and interesting but where they will not find the answers to the burning question of the hour.

T. E. O.

SYNOPSIS OF OBSTETRICS AND GYNÆCOLOGY. Eighth Edition. By Aleck W. Bourne, M.A., M.B., B.Ch.Camb., F.R.C.S.Eng., F.R.C.O.G. Bristol: John Wright & Sons, Ltd. 1941. Pp. vii + 490. Price 15s. net.

This well-known and tried publication has been thoroughly revised and brought up to date.

So thoroughly does it cover its subjects that it must now be considered more as a book of quick reference for the experienced practitioner or specialist than as a revision manual for the student.

Criticism is difficult but no mention is made of the position of the patient



Photograph by Dorothy Wilding.

Buckingham Palace.

March 5, 1942.

HER MAJESTY THE QUEEN has been graciously pleased to become Colonel-in-Chief of the Royal Army Medical Corps, in succession to Field Marshal His Royal Highness the late Duke of Connaught.

The especial honour thus conferred upon the Royal Army Medical Corps, of which the Corps is justly proud, has given the greatest pleasure and satisfaction to all ranks.

The appointment affords further evidence of the keen and lively interest that Her Majesty has always shown in matters related to the care of the sick and wounded.

The Royal Army Medical Corps pledges itself to do its utmost to be worthy of its new Colonel-in-Chief.

Authors are alone responsible for the statements
made and the opinions expressed in their papers.

Journal of the Royal Army Medical Corps.

Original Communications.

“BLITZKRIEG.”

AN APPRECIATION.

By BRIGADIER E. M. COWELL, C.B., C.B.E., D.S.O., T.D.

(Continued from page 62.)

Chapter X.—The remaining three chapters of the book are devoted to principles and methods of defence and hold points of special interest in the defence of Great Britain.

The linear, frontal defensive systems of the end of the first Great War, organized in depth and in a series of successive defensive zones provided with machine-gun and artillery fire power, can no longer stand the new method of attack. A barrage that stops infantry moving at two miles an hour, cannot stop the swiftly moving tanks of a *Schwerpunkt*.

The break through knocks out the elaborate fire plan, which was essentially a frontal one and was not calculated to fire to the flank or rear.

The answer to the new methods of attack, the Blitz, is to organize new methods of defence.

Defence is needed against (a) irruption by tanks and (b) infiltration by assault groups, made up mostly of infantry, and both being supported by the air arm.

The first aim of infantry threatened by tank irruption is to split the attacking force into two parts. The defensive system is built to retain some power of resistance after the Panzer assault group has passed through it. This resistance will not only delay the normal infantry divisions but will sever the armoured and motorized divisions from their sources of ammunition, petrol and supplies. The second aim and requisite of the new defensive

system is to provide a delaying action, to gain time for armoured forces in strategic reserve to come up to relieve the situation.

In place of movement, good use of ground must be employed and a defensive position selected in tank-proof country.

The German Army designs its defensive system on three basic principles:

(i) *Defence in depth* is now designed to act as a filter, disintegrating the attacking force, allowing some parts through and holding back others.

The forces that penetrate search for the flanks of the defending units and find instead their own flanks and rear harassed by counter-infiltration.

The following advantages occur when the units and sub-units of a defending force are dispersed in depth throughout a divisional area and not behind a single anti-tank obstacle such as a river: (a) The component units can fight independently, even when surrounded; (b) battle opens up on all sides of the penetrating formation—thus (c) dispersing his fire power and rendering it less effective; (d) dispersion allows for selection of better natural tankproof obstacles.

(ii) *Invisibility* of the defence is helped by the dispersal in depth. Linear defence systems show up, are easily seen and destroyed.

Invisibility is obtained by making full use of natural features, such as small towns, villages, woods, farms and quarries. It may be supplemented by camouflage including the building of false fortifications, gun positions, etc.

Reverse-slope positions are visible from the air but still afford useful points for organized resistance.

Whilst remaining concealed, enemy movements must be looked for in all directions in order to avoid being surprised.

(iii) *Readiness for action*, “*Schlagfertigkeit*” is the term for the third of the German principles of defence.

This embraces the organization and employment of the form of fire appropriate to the occasion and the launching of counter-attacks at the right moment.

Chapter XI.—The account of the “islands of resistance” follows the description of defence in depth.

The island of resistance differs from the strong point in a linear defence system, in that it is more powerfully armed and having its own trench system is not linked up to neighbouring islands. It is self-supporting and capable of defence with an all round field of fire.

The lay out of units in a divisional area on the island system is planned in a chess-board pattern with 400 to 800 yards between each.

The heart of the island consists of the close support weapons; the infantry form a protective crust and shock groups are ready for counter-infiltration.

The groups vary from company to brigade or divisional size. The larger groups are subdivided into smaller independent subdivisions.

Divisions co-ordinate the fire plan and all headquarters are linked by wireless.

The forward islands are given anti-tank protection by (a) minefields and (b) anti-tank guns.

After fire the principle of movement must be considered. When the enemy has infiltrated and is exhausted, small assault groups deliver "counter-punches" (Gegentoss). Two or three sections of selected infantry under careful leadership and after detailed planning are launched on the raid. The small size of the group permits of concealment and mobility. The groups must acquire an intimate knowledge of the ground and be able to find their way in and out of the wire of their own and neighbouring islands. They retire when tanks appear but filter out again to harass the following infantry.

The garrisons of the islands do not defend lines but areas. Plans are co-ordinated by a Commander located in the chief island of resistance; a post is chosen for its suitability for observation and communications are maintained by wireless, visual signalling, telephone, rockets, flares and Vercy lights.

The responsibility of Command and Staff in this form of fighting is co-ordination of fire and movement, leaving the details to the initiative of the individual sub-unit commander, the man on the spot.

In this form of fighting each man must be encouraged to develop the utmost confidence in his own powers. The morale must be so high that he must go on fighting even when all seems lost; and the officers will set the example.

Defence must always be active and aggressive.

Fortification of the islands is secured by (i) a surround of tank-proof terrain, (ii) the laying of mine-fields, (iii) the making of internal field fortifications, (iv) wiring, (v) defence against flame-throwers, (vi) provision of stocks of ammunition, food, water, etc., sufficient for several days.

(i) The chief natural tank obstacles are—water, marshes and boggy ground; rocky ground and a slope of over 45° ; close woods of trees of 10 to 18 inches diameter; villages and towns are dangerous defiles. Artificial obstacles are felled trees, ditches, pits and anti-tank mines.

(ii) Anti-tank mines may be considered as barrages already laid down and lasting for a considerable time. A German division is allotted 13,000 mines or 30 lorry loads. To effectively mine the whole of a divisional area some 100,000 mines are required or approximately 240 lorry loads. The passages through mine-fields must be guarded by sentries and covered by strong concentrations of anti-tank guns.

(iii) Field fortifications were devised in Spain on a new plan, a system of slit trenches was introduced by the Germans, perfected by Lieutenant Miksche and named from its shape the "hammer" system. Circular concrete pill boxes for machine guns can be constructed. They will be protected from direct attack by rifle pits lying outside them.

(iv) Barbed wire surrounds each island and within are wire aprons to provide an inner and outer ring of defence.

(v) Flame-thrower attacks may be made against strong positions.

Modern types have a range of 100 yards and are supplied from fuel containers on wheels, either man-handled or drawn by special tanks. Obstacles should be designed and placed to stop such vehicles. If this is not possible, screens should be made to protect pill-box loop holes.

(vi) Normal supply is continued until enemy penetration has taken place. If stocks of supplies run out, fresh supplies can be dropped by parachute (400 rations from one machine).

These islands of resistance form the bricks from which “web defence” is built up.

Chapter XII.—The plan of defence advocated by the author of *Blitzkrieg* consists of two parts (i) the Web Defence and (ii) the counter-blitz, described in the next chapter.

The framework of web defence is made up of two principal positions, the first being separated from the second by a “guerrilla” area. The first and second positions are connected on their flanks by transverse barriers, switch-lines or *Riegelstellung*.

The first position is sited on ground favourable for defence and manned by infantry divisions “of the front line.” The second position, 10, 20 or more miles to the rear, is located with reference to the best natural defensive position available and is held by reserve divisions.

These two positions and the transverse barrier zone are organized and built up on the island brick system.

The guerrilla zone is planned of such a depth that the attacker cannot pierce the two positions “at one leap.”

Each position consists of four elements:

(i) *The outpost zone*, consisting of small posts for observation and listening, which must be close together, well concealed, frequently changed and in full communication with the H.Q.

(ii) *The “filter zone”* or main area of resistance, made up of island bricks organized for all round defence, is where the chief fighting will occur.

This is not a line to keep the enemy out but a zone to allow some part of the attacking force to penetrate so deeply that it can be destroyed. As irrupting tanks advance between the islands they become split up with progressively smaller parties, the “sieve” action.

If the enemy infantry are held up, the attack is split into two parts and the Panzer groups are cut off from petrol, ammunition, supplies and reinforcements.

(iii) *The rearguard posts* ring round a reserve area of the filter zone, where the heavy guns, Command H.Q.s, dumps and transport harbours will be situated. These posts face in all directions and protect the rear against paratroops or troops landed from the air. They also deal with penetration by small enemy parties operating by night.

The troops of the reserve are in a zone contained within these rearguard posts. If a thrust-point succeeds, these troops deepen the defence by forming further islands of resistance. Reserve troops from another sector

deliver counter-attacks on each flank of the enemy. They begin by advancing frontally and then swing right and left in a pincer movement. The counter-attack is timed to meet the mopping-up echelons, after the first echelons, the reconnaissance and fighting tanks and motorized elements have gone through. A battalion group with close-support artillery and some I-tanks is a suitable formation for such an attack.

The reconnaissance unit should be located in this reserve zone. Their task is to protect lines of communication in the guerrilla zone, act as anti-paratroop patrols, follow up any irrupting tanks and also act as a reserve assault group.

(iv) *In the guerrilla zone* web defence is laid out on a different scale. In the front and rear divisional areas the net work is a fine one. In the guerrilla zone the meshes are coarser, the nodal points embracing towns, villages, important road junctions and bridges being formed into or covered by the fire of islands.

The troops in this zone should use the methods of guerrilla warfare. They should fight offensively, appearing and disappearing and continually harassing the enemy.

Towns are organized for this form of fighting. The enemy having pierced the perimeter defences by the use of heavy tanks, heavy gun fire and dive bombing, finds himself in narrow streets. Air and artillery support are no longer possible and guerrilla tactics will be successful.

(v) *The transverse barriers*, that link the first and second positions, are designed to block off the areas of enemy penetration, to make the widening of the gap difficult and to prevent his fanning out for his drive into the second positions. They are organized on the same principles of "island bricks" with outpost zones on each side of the barrier and a reserve zone along its centre. Such barriers should be organized every 20 to 40 miles.

With the modern idea of fighting in depth immense distances are involved. In this system the following distances may be taken as normal, in the case of an infantry division occupying a frontage of four miles.

								Miles
1.	Outpost	...	...	...	...	...	...	$\frac{1}{2}$
2.	Filter	...	...	...	...	...	...	2 $\frac{1}{2}$
3.	Outpost and reserve	...	...	...	...	...	...	1
Total forward division								4
4.	Guerrilla	...	...	...	...	...	...	25-50
5.	Reserve Division	...	...	...	...	...	...	4
Total depth of force								30-60

This chapter closes with the observation that "no strategically passive defence can hold for ever against the immense powers of modern weapons and the rapid concentration of these weapons made possible by the petrol engine. Therefore the question of strategic counter-attack is of equal importance to that of the organization of a defensive system."

Chapter XIII. The Counter-offensive or Counter-blitz.—The use of

tanks, the employment of the air arm, the increase in fire power and the motorization of the infantry has given a new importance to initiative and attack.

The principal role of the infantry divisions is defensive. There is only one answer to tanks, the provision of a superior number of more and better tanks to operate with a superior air force, and a better equipped and more highly trained motorized infantry and shock troops; the whole force imbued with a will to win based on the highest motives.

Initiative and speed enable the attacker to concentrate so rapidly and to shift his local superiority so swiftly that, unless the counter-move is made by forces moving equally fast, it will be too late.

If the enemy is tangled in the web of defence he can be delayed until all preparations are made for the attacking force to move up. The installation of traffic control, A.A. protection and administrative arrangements, including supplies, all takes time. Again local air superiority must be established before the attack can be launched; including fighters to umbrella the routes, bombers to pin down the enemy air force in its aerodromes and reconnaissance machines to watch the movements of both sides. In action concentrated air support is essential.

Further delay in the advance may be caused by the blocked roads with a vast mass of fleeing refugees.

Where should the counter-attacks be launched?

They should not be used merely to form a new defensive position, but may be put into the battle area already chosen by the enemy for his Blitz or will be better used to boldly strike the enemy front in the sector next to the Blitz. Having penetrated enemy territory, the attack continues towards the crowded roads that are carrying up troops and supplies. This is the true counter-blitz made possible by mobility of armoured forces and flank defence by the islands of web resistance.

This is the "G" picture of modern war, vividly painted by the gifted author of "Blitzkrieg."

The book has been reviewed *in extenso*, because of the importance of the new doctrine of war therein described.

Readers are invited to make their own medical arrangements for the varying phases of fighting.

A further article, embodying possible solutions, may appear at a later date.

"SOLDIER, SAILOR OR RUDDY DOCTOR"

FIELD AMBULANCE WORK AT NARVIK.

By MAJOR W. M. EVANS, M.C.,

Royal Army Medical Corps.

THE operational roles of several sections of the Royal Army Medical Corps have undergone such changes from the stereotyped book teaching with which we started this war, and will probably still suffer more such changes before the war is finished, that the following account of experiences of one Field Ambulance may be of interest. The reader will early reflect that little of the ordinary training of the Field Ambulance appears to have been of practical benefit except, perhaps, first aid, yet the organization was sufficiently flexible for the unit to cope with the circumstances and to give quite a creditable account of itself.

This particular Field Ambulance was formed in 1938 to complete the allotment of three Field Ambulances for a Division, and expanded from peace establishment to war establishment in April, 1939, as part of the general expansion of the Territorial Army. It was fortunately able to complete one annual camp at full strength in the summer of 1939 and returned home about a fortnight before embodiment. The personnel had thus been able to get to know each other very well and, in fact, formed a very happy family. The officers were almost all general practitioners and the men chiefly artisans from a large industrial town specializing in the heavy industries, with very few having practical experience either in the Army or civilian medical institutions.

The unit was ordered to mobilize in February, 1940, and was instructed to concentrate training on antigas and working in the darkness. Whether this was intended in the interests of secrecy as a dust thrown into our eyes or not was never discovered but eventually the unit found itself as part of the force which was to take Narvik.

The unit embarked on April 11 and within a few hours set sail from a northern port. After reaching the open sea the convoy turned north, picked up several more ships and eventually totalled thirty to thirty-five ships, the numbers never remaining constant for long because slim destroyers dashed off into the mist at times and almost miraculously reappeared a few hours later.

After three days at sea we awoke one morning to find the convoy much smaller and we learned afterwards that the Namsos and Aandalesnes detachments had left us. Next day we crossed the Arctic Circle and, on the following day, anchored in Vaags Fjord (fig. 1). The beauty of the scenery was almost beyond description; the sea was lovely blue, very clear and its sur-

face merely disturbed by ripples which served to reflect the brilliant sunshine into myriads of scintillating shafts of light. The land consisted of high towering mountains, snow covered and showing no signs of vegetation. At the foot of the mountains was a narrow band of flat land on which could be seen small clusters of houses painted in many bright colours, also reflecting the sunshine and giving the impression of toy doll's houses arranged by some childish hand. The whole was a scene not easily forgotten.

Here we had our first attention from the enemy—a lone Heinkel suddenly skimmed one of the mountains, descended on the ship, machine-gunned us and dropped a couple of bombs. There were no casualties and little

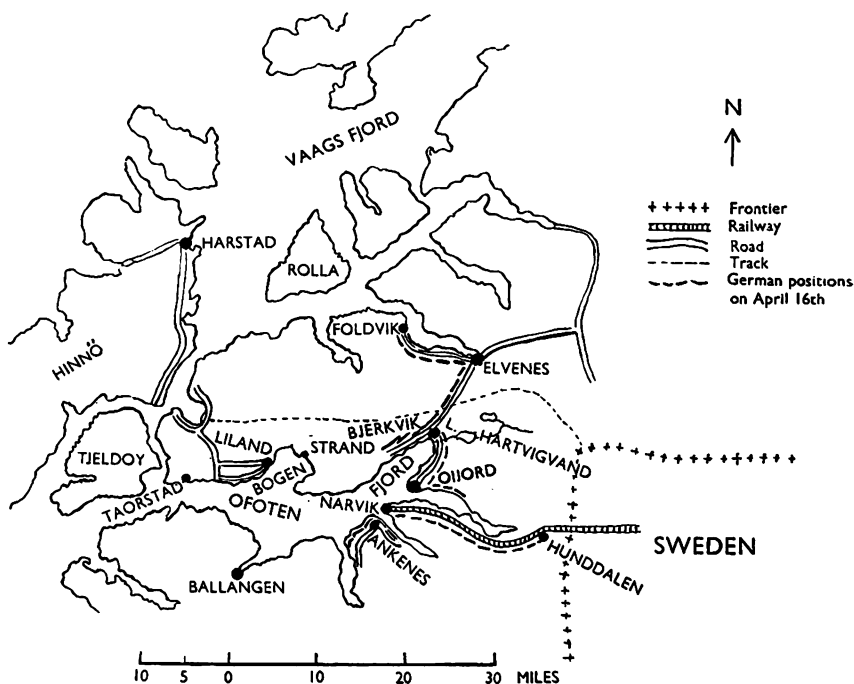


FIG. 1.

damage to the ship. A small Norwegian fishing cobbler, of the type we later called "puffers," was holed and sank within a few minutes, the crew escaping in their own dinghy.

Disembarkation into destroyers commenced, Signals and Infantry going before the Field Ambulance and other auxiliary troops. When our turn came next day, I found myself senior Army officer on board the destroyer, and, as such, was invited on the bridge. The Luftwaffe returned to complete the job started the day before and it was most amusing to watch our skipper calmly looking up to see where the bombs were falling and directing his ship away from them. Our course must have been one glorious zig-zag. We

eventually landed at Harstad, a small Norwegian fishing port on the island of Hinno (fig. 1) and the unit was allotted a billet area a mile outside the town and reached by means of a steep road almost knee-deep in soft snow. The labour of man-handling our 22 tons of stores up this road became more obvious as it progressed. All our stores had been split into packages roughly 80 pounds in weight. Even so, all ranks were glad when the job was completed.

The billets were chiefly houses and barns owned by the various ramifications of the family of a man who had spent some time forty years previously

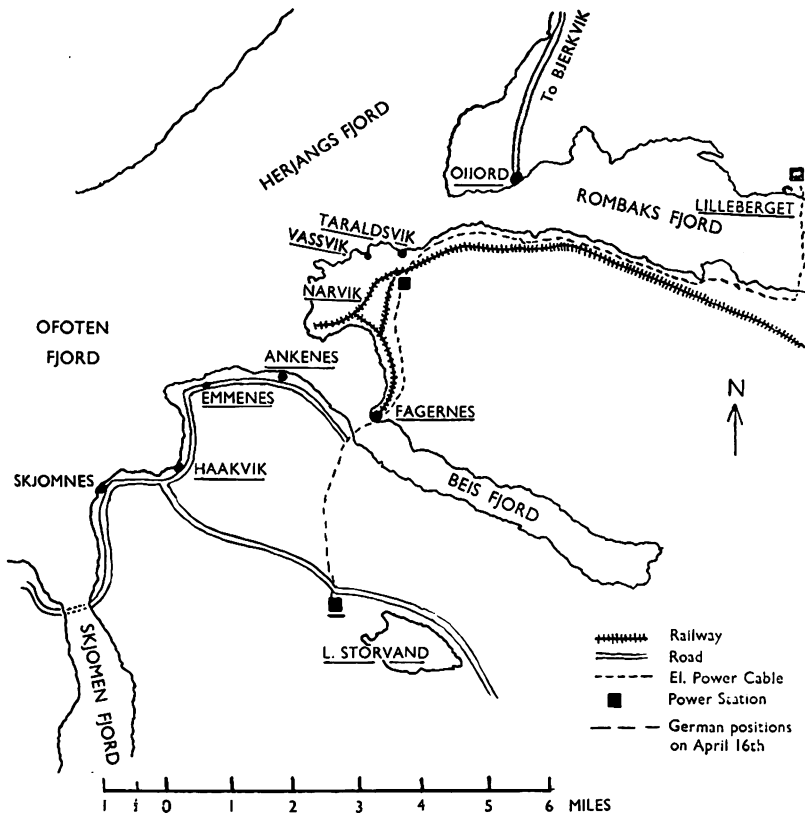


FIG. 2.

working in a Grimsby shipyard. He was most helpful but did not hesitate to draw a revolver on one if he felt the occasion demanded it. At this time the Norwegian people were unable to do too much for us. After two days shuffling and adjusting, the billeting arrangements were regarded as satisfactory. Then the snow started and continued for the best part of five days, reaching blizzard intensity at times. The effect was to add another five feet of snow to the five already on the ground. Unfortunately the unit had been

unlucky in the issue of arctic kit, particularly boots, with the result that "care of feet" became an urgent and continual anxiety.

After the blizzard we were treated to a spell of lovely sunshine and the stimulating effect of this on all ranks helped to mitigate the discomforts. The unit spent one week in billets, time spent valuably on checking and arranging stores, putting men through upgrading tests and liaising with units with which we would have to work in the near future. By means of this

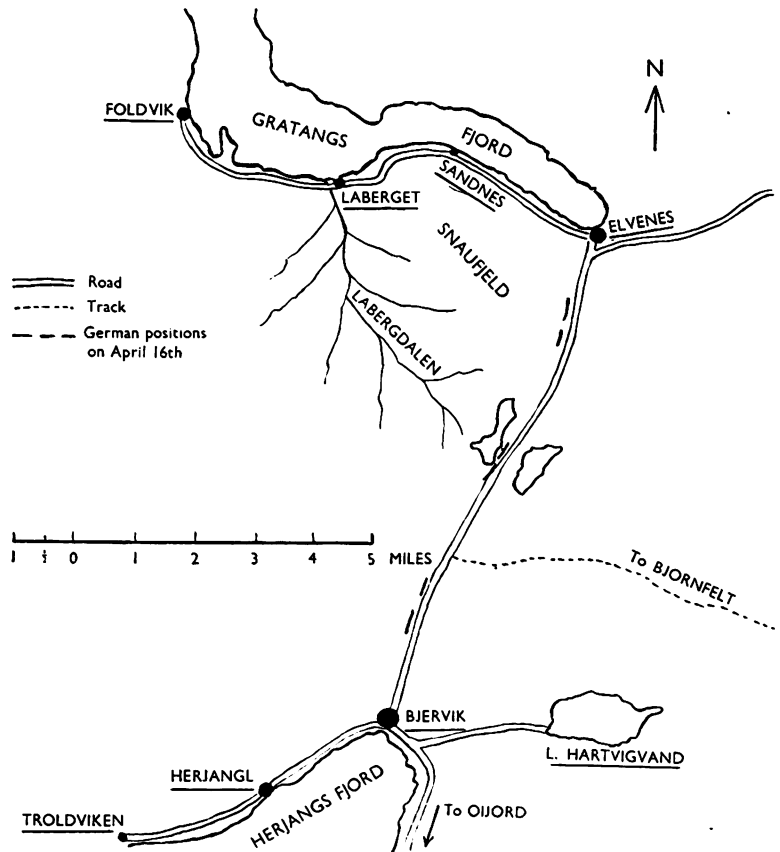


FIG. 3.

liaising and with the help of Intelligence Summaries, one was able to get a good idea of the tactical situation.

Briefly it was as shown in figs. 1, 2 and 3.

German positions on April 16 were:

The German main body was in Narvik itself and probably consisted of 2,000 to 3,000 men. Line of communication troops were safeguarding the iron ore railway as far as Hunddalen on the Norwegian-Swedish frontier.

South of Narvik (fig. 2).

Enemy posts were known to be at Fagernes, Ankenes and round the peninsula as far south as Haakvik. He had also occupied the high ground forming the backbone of the Ankenes peninsula and his ski troops patrolled as far as Skjomen Fjord, thus safeguarding the electric power station on L. Storvand, and the cable running to Narvik.

North of Narvik (figs. 2 and 3).

Enemy concentrations at Oijord and Bjerkvik with well-planned machine-gun posts covering the intervening road. Machine-gun posts also along the north shore of Rombaks Fjord at any rate as far east as Lilleberget. This safeguarded the power stations near Lilleberget and the cable running into Narvik.

From Bjerkvik the enemy had pushed outposts along the north shore of Herjangs Fjord as far as Herjangle and Troldeviken and northwards along the Bjerkvik-Elvenes road. He had a fairly strong force in Elvenes with outposts pushed westwards along the road as far as Foldvik and southwards to link up with those from Bjerkvik.

In general then, the enemy held the line running roughly North and South, pivoted on Narvik, with the Swedish border 25 to 30 miles behind him. He had fortified the high ground wherever possible and this, plus the fact the high ground was really high, consisting of steep rocky mountain covered with snow, and that all approaches from the West were easily dominated, had given him an extremely strong defensive position. His weakness was that his lines of retreat were very poor consisting only of one small track running over the mountains from Hartvigvand to Bjornfjelt, just inside the Swedish border and the railway from Narvik to Hunddalen. Elsewhere the mountains were impassable to everything except lightly equipped ski troops.

The order of battle of the enemy, as far as was known to us, consisted of three regiments of Alpinists, some Bavarian Jaeger units and a sprinkling of Prussians. In addition, the survivors of the seven German destroyers sunk in the first and second naval battles of Narvik were known to be still in Narvik.

His aerodrome was the frozen Hartvigvand, with the assistance of air sorties from Trondhjem, and he appeared to be receiving reinforcements by seaplanes landing on Rombaks Fjord.

The Approach March.

On April 27 one British battalion of the S.W.B. with "A" Company of 00th Field Ambulance moved out from Harstad and after a short stay at Lilland moved on to land at Skjomenes.

About the same time, Chasseurs Alpins landed at Foldvik on Gratangs Fjord and pushed eastwards. After they had pushed the enemy beyond Sandnes, "B" Company of the 00th Field Ambulance landed there and established its A.D.S.

These operations were the opening of a pincer movement to force the enemy into Narvik.

H.Q. Company of the 00th Field Ambulance was established in a small coasting steamer, S.S. "Trondenes"—later registered as a hospital ship. In addition the unit was allotted two small fishing cobbles driven by Diesel engines and which emitted a characteristic noise producing the very appropriate soubriquet "puffers." One of the puffers was allotted to "B" Company and the other was retained by H.Q. Company until it could be handed over to "A" Company, that Company having departed with the S.W.B.s.

At this stage, such roads as existed were absolutely impassable to wheels of any sort and collection of wounded was by hand carriage or sleighs and evacuation by water.

No. 7 C.C.S. was established at Taorstad on Ofoten Fjord—20 odd miles from Skjomnes where "A" Company had its A.D.S.

"A" Company evacuation was through the C.C.S., "B" Company direct to the General Hospital at Harstad, a distance of 34 miles. S.S. "Trondenes" was capable of 10 knots, the puffers of 6 to 8 knots.

Contact and First Phase. May 1 to 12.

This phase, written purely from a Field Ambulance point of view, was a period characterized by really hard work on the part of the companies, much going and coming on the part of H.Q. Company and considerable air attack on all companies.

"B" Company. A.D.S. at Sandnes evacuated wounded of Chasseurs Alpains. The A.D.S. was dispersed in unoccupied houses with the bearers working eastwards towards Elvenes-Bjerkvik road. Relay posts had been established along each route but even so conditions made the carries very laborious and the work became even more difficult later as the snow melted. At one time one of the carries in the Labergdalen took four hours; this in three to four feet of snow and subject to repeated air attacks.

Fortunately battle casualties were not very heavy but the French had a fair number of frost bite cases.

Rations for "B" Company at this stage were "Composite rations," all preserved commodities, but they were able to supplement this by barter with the French and such Norwegian civilians as were left.

"A" Company. At Skjomnes, later Haakvik. The A.D.S. was first at Skjomnes and later pushed up to Haakvik—carries were generally long but conditions were not so severe as with "B" Company. Being nearer to Narvik they were, however, subject to more frequent and more intense air attack. In addition, enemy ski patrols were constantly crossing the mountains from inland, making life in the A.D.S. quite exciting at times. The ridge between Haakvik and Ankenes itself proved too big an obstacle for our troops under conditions at first, so activity was chiefly centred on the coastal road. As ground conditions improved it became possible to use

wheels so two light ambulances were allotted to "A" Company and proved a great boon.

H.Q. Company in S.S. "Trondenes." During this stage H.Q. Company spent the time chiefly in evacuating A.D.S. of "A" Company but made one or two trips to "B" Company at Sandnes. In addition H.Q. collected and evacuated casualties from the Navy. The latter presented problems of its own, particularly with regard to the "lifting" of stretcher cases, often from deeply hidden corners and along narrow corridors or steep companion ways 'tween decks. Our best effort was a compound fracture of both legs, weighing 18 stones, who had to be taken from a single bunk, carried up two companion ways and finally evacuated to S.S. "Trondenes."

It was during this period that the title of this article was born. I had received a wireless message, via the Navy, to pick up some casualties from a certain cruiser but when I contacted that cruiser she had transferred them to another one which had gaily departed into the "blue." After several hours of glorified hide and seek the casualties had not been found so I retraced my steps determined to speak to the first British warship and enlist its help. About 2.30 a.m. I found a small armed trawler anchored for the night under the lee of a towering mountain so I hailed it. In a few minutes an apparition clad in a very "off-white" sweater and grey flannel trousers turned out and treated me to the finest flow of language heard outside Billingsgate. The only retort I could muster to his very embellished query as to my identity was—"I don't rightly know. I'm either a soldier, a sailor or just a ruddy doctor—but who, etc., etc., are you?" However, he helped considerably and in a short time I had found the casualties.

Apart from the evacuation of wounded, much time was spent in fitting out the S.S. "Trondenes" as a hospital ship. Canvas awnings and screens were fixed to enclose decks and Bréchet gear mounted to carry the stretchers. The original passengers' saloon was fixed up as a treatment room and as many bunks, etc., as could be filched were arranged for patients. The Norwegian crew consisted of three officers and about twenty men. These with the personnel of H.Q. Company made the ship already very crowded yet, when the transition was complete, 150 stretcher cases and about 100 sitting cases could be accommodated. Orders were given to display the Geneva Cross—to the great disgust of the Norwegian crew. I secretly sympathized with them. It is not a joke to sit in a ship "waiting for it" while Jerry circles just above, mast high, giving one the "works." A machine-gun would have been more pleasing to the Norwegians than the Red Cross. However, the ship never received a direct hit. Here I must pay tribute to C.R.E., Narvik force. No matter what one wanted, or when, he was always most helpful. He must have come to hate the name of Trondenes and its alterations yet he never lost patience nor his ingenuity in obtaining what we wanted.

During this period, when enemy air forces paid us considerable attention, the Navy came to our rescue with gifts of lifebelts. In the space of a day

and a half one was able to beg sufficient lifebelts for all the personnel. They were of the cycle type and could be worn comfortably, semi-inflated, underneath a battle dress blouse. It was but the work of a few seconds to inflate them fully. Also at this time one encountered the question of maintenance of ships. The "Trondenes" was a coal-burning ship which could only bunker in Harstad but could take on water at Ballangen in addition to Harstad. The puffers were Diesel burning and could obtain oil at Harstad or Lilland. The "Trondenes" was due for boiler scaling and bottom scraping and one or two of the puffers needed engine overhauls. All these, for us, unusual features had to be solved and one was considerably helped by the Norwegian crews but almost more so by one or two men of the unit who had had deep sea experience in fishing trawlers. One particularly dubbed "The Admiral" did exceptionally well.

Rations for H.Q. Company during this period were almost entirely composite and, unfortunately, no opportunities came our way to supplement them.

Phase II. The Assault on Bjerkvik, May 13.

By this time, in the north, the enemy had been pushed out of Elvenes and in the south he was held in Ankenes. It was decided to attack Bjerkvik by combined land operations and a seaborne landing.

The plan was: (i) Polish troops advancing overland from Bogen towards Troldviken, Herjangl and Bjerkvik; (ii) two battalions French Foreign Legion to land at Bjerkvik after preliminary bombardment by Royal Navy.

No British troops took part in the assault except ourselves and reading my diary entry for that day I find a note to the effect that the C.O. asked me to record the fact that all our work for the previous fortnight had been with foreign troops.

The medical arrangements were that one bearer company of the Field Ambulance detached to command of O.C. Field Ambulance should follow the Foreign Legion in at Bjerkvik. Two bearer squads from 00th Field Ambulance were attached to the Poles and I, with the remainder of the H.Q. Company, should lie off in S.S. "Trondenes" with two puffers to evacuate casualties from A.D.S.s to S.S. "Trondenes." Actually the plan worked quite well, the Poles encountering little opposition until they reached the outskirts of Bjerkvik and so had few casualties in the early stages. After Bjerkvik was taken, Polish casualties were evacuated from there. Here we had one stroke of luck. The wooden jetty at Bjerkvik was mined but the Germans had not blown it, thus it was available for our use—an important point to us always was whether there was a usable jetty. The one at Bjerkvik was somewhat damaged as a result of R.N. shelling but in a short time was working efficiently. All casualties were evacuated to S.S. "Trondenes" before 8 p.m. and by that time the Foreign Legion and Chasseurs Alpins had met on the Elvenes—Bjerkvik road. The enemy were retiring eastwards and by May 18 had reached the area Lillebalah, 7 miles east of Bjerkvik. Hartvigvand was in our possession along with nine or ten Heinkels

which had frozen to the ice, but the loss of Hartvigvand did not appear to lessen the enemy's capacity for annoying us.

As all casualties could now be evacuated through Bjerkvik, "B" Company at Elvenes went out of business but remained there for a few days having a well earned rest. They were later ordered back to Harstad but were bombed on the way and only just managed to beach the ship in time. They were later rescued and brought to Harstad.

After the capture of Bjerkvik, it suffered severely from enemy air attack but the Foreign Legion continued attacking, eventually reached Oijord and turned eastwards towards Lilleberget. During this period one came into intimate contact with the Navy again as they were covering the French advance. I was forbidden to take any risks with S.S. "Trondenes" so I used puffers, and it was a heartening experience to proceed up Rombaks Fjord with a destroyer escort to collect French wounded, the destroyer doing its utmost to demolish the many tunnels on the railway and so silence the guns on railway mountings which the German was using.

The end of this phase saw the Allies in possession of all former German positions except Narvik, Ankenes and the railway running East to Hundalen.

The stage was now set for the final assault on Narvik.

Phase III. The Assault on Narvik, May 27.

The plan was simultaneous attacks from Oijord on the North and Ankenes on the South.

Oijord Attack.

Two battalions of Foreign Legion and two battalions of Norwegian infantry landed by M.L.C.s at Taraldsvik and Vassvik, north east of Narvik. The Norwegians were to take the town of Narvik and the French were to push along the railway, take the high ground south of it and cut off the enemy's retreat.

The naval bombardment commenced at 22.30 hours and was magnificent. The infantry went in at 23.30 hours. The arrangements appeared to work without a hitch. The medical dispositions had been made and checked and, as there was no prospect of wounded for some little time, another British M.O., a French M.O. and myself took up position on a hill overlooking the proposed place of landing. We had a ring-side seat—but not for long.

The medical arrangements for this attack were: The French had a Poste de Secours on the reverse side of a hill just north of Oijord, "A" Company of 00th Field Ambulance came down from Bjerkvik and evacuated Oijord to Bjerkvik. H.Q. Company 00th Field Ambulance evacuated from Bjerkvik. My job was to clear the A.D.S. at Bjerkvik and keep contact with the French Poste de Secours in case it moved across the fjord. Fortunately we had been given three puffers and one was able to arrange a shuttle service from Bjerkvik to the C.C.S. at Taorstad. Wounded commenced to arrive in the Poste de Secours in the early hours of the 27th and continued in a steady

stream. At first, there were only a few Norwegians as they had made their own arrangements but later one saw more Norwegians. Air attack was almost continuous both on ourselves and on the ships of the Navy giving support fire. One of the puffers with almost regal disdain steered a straight course down Herjangs Fjord while concentrated bombing was being directed on three ships zigzagging in the fjord. Bombs dropped all around her for at least an hour but she got through untouched.

By the evening of the 27th Narvik was captured, the French were advancing along the railway and the Poles were making progress on the Ankenes side of Beis Fjord.

The French Poste de Secours is something between our old conception of an A.D.S. and an M.D.S. The equipment includes a portable operating table, a large variety of splints, almost all made of aluminium, and a good supply and variety of surgical instruments.

All patients on admission to the Poste receive a thorough treatment including a series of hypodermic injections, all cases had antitetanic serum, antigas gangrene serum and an anti-enteric injection, the nature of which I was unable to ascertain. In addition if a man was collapsed he got coramine, if he was not collapsed he got morphia. All this and the thoroughness of the surgical treatment took time and, as air activity was very intense at one period, it was decided to cut out the Poste de Secours if possible so puffers were diverted from Bjerkvik and brought to a convenient beach nearby and evacuation was effected in that way.

The following day evacuation was direct from Narvik itself.

This was comparatively easy as the French took their casualties to the Norwegian civil hospital and the Norwegians resumed control of their own. My puffers were able to use the jetty at Vassvik and with the assistance of wheeled stretchers and a few borrowed Norwegian lorries the carry from the hospital to the jetty was done quickly and easily.

Narvik itself, comparatively untouched except for the destruction of the railway yards, etc., by the British Navy, now began to receive air attention and I was called on to help in the evacuation of civilian women and children. This evacuation had been organized by a young lieutenant of the Royal Navy who was acting as Naval Liaison Officer. My puffers helped him to the extent of several hundred evacuees in a few hours. Incidentally, I found three British sailors, survivors of H.M.S. "Hardy," in Narvik hospital where they had been placed by the German authorities. Their delight at seeing a dirty British battledress was unbounded and my apologies for the humble transport in a puffer to the officer among them were quite superfluous.

The Ankenes Attack.

This attack was timed to coincide with the landing on the North side of Narvik but as I was not actually present, the details were not known to me. Two battalions of Poles advanced from Haakvik, one along the coastal road and the other over the mountains to cut off the enemy's retreat eastwards

out of Ankenes. The mountains, though steep and rocky, were by this time clear of snow.

The medical arrangements were as follows: "A" Company had an A.D.S. at Haakvik and later established a second one around the point at Emmenes. The Poles had their own R.A.P.s. I believe that, because of the language difficulty and the consequent liability to misinterpret messages, it was decided at the outset that the A.D.S. at Haakvik should not move. At any rate, the Poles had reached a point opposite Fagernes and they gaily refloated some abandoned boats and I got their wounded out through Narvik.

Soon after this, arrangements for the evacuation of Northern Norway were put in hand, much to the disgust of the French who, by that time, had pushed the Germans almost into Sweden. As is well known the evacuation was effected without the loss of a single man though, of course, contacts were lost and it was not until one reached the United Kingdom again that one found the unit reunited.

The Narvik episode was extremely interesting, the climate was very unkind at first but, after the snow had gone, conditions were fairly comfortable. The Field Ambulance worked in, I believe, a unique role and most of the time served almost anyone except the British Army. It must be left to others to judge whether it acquitted itself well or not.

THE RECOGNITION OF IMPURITIES IN WATER.

By LIEUTENANT-COLONEL F. C. HILTON-SERGEANT, M.B., CH.B.,
Royal Army Medical Corps.

THERE can be no doubt that the rapid and regular provision and distribution of drinking water in the field is dependent upon the *early* recognition in the first instance of impurities in all potential sources of supply.

With this aim in view reconnaissance is necessary in order that the use of water which is poisoned may be avoided and in order that the source or sources eventually selected may be of such a nature that their clarification and subsequent sterilization can be carried out as expeditiously as possible.

It has been said that two kinds of reconnaissance are necessary for the inauguration of a water supply in the field. The first is done for the purpose of framing a water supply policy. The second is concerned with the actual arrangement of the supply.

In formulating a policy it is necessary to determine the total quantity of water available in the proposed theatre of operations and how the existing sources can be developed. It has then to be decided whether adequate supplies are available locally or whether water must be transported from a distance.

In an enemy occupied area the above information can be amplified by statements from refugees, prisoners, aeroplane observation, etc.

The actual water supply organization of the Royal Engineers as regards personnel and equipment will depend largely on this information, for example, the formation of a Water Tank Company, R.E.

The general policy having been decided, it is implemented by the adoption of methods of supply which are particularly suited to the area or country concerned.

In order to arrange a supply that will be satisfactory, it is necessary to know not only the quantity of water that is available from specific sources but also its quality. The former is affected chiefly by variations of climate and weather but the latter is dependent upon numerous human factors, a great many of which can be controlled. No laboratory analyses, even though they be carried out at short intervals which is quite impracticable under field conditions, can ever take the place of personal inspection of an area.

Only in fact in this way can an expression of opinion of any definite value be given and a reasonable selection made.

The protection of accepted sources is also a matter to which consideration must be given; this may involve nothing more than the posting of a sentry in the first instance but subsequently constructional work, in the form of fencing, etc., combined with regular supervision of all catchment areas, may become necessary if the supply is to remain in use over a long period.

Existing piped supplies in billets, for example, do not *ipso facto* constitute an adequate and safe drinking water. Questions affecting the development of the supply and the adequacy of storage and distribution facilities have to be investigated with particular reference to the proposed number of consumers.

The proportion of water available from surface sources such as lakes, rivers, canals and from underground sources varies according to the nature of the ground and the topography of the area.

Whereas surface sources abound in a country like the British Isles, the opposite is the case in Libya, for example, where such wells as exist are few and scattered. It is in the latter circumstances that soluble impurities in water, whether occurring naturally or introduced by enemy action, are likely to hamper water supply arrangements.

It has nevertheless to be remembered that, by rendering the water supplies undrinkable, one's own forces may during a subsequent advance suffer a considerable handicap for the same reason.

In first examining a source, particularly in an area recently occupied by the enemy, careful search is to be made for booby traps liable to cause pollution and for the presence of poisons in the water.

The absence of poisons from water must be confirmed before the routine process of *clarification*, that is, the removal of suspended matter, and *sterilization*, by which is meant the destruction of organisms causing disease when the water is drunk, is put into operation.

Obvious poisons such as engine oil and petrol, cresol, carcasses, excreta and gross quantities of soap and salts will be suspected from the colour, odour or taste of the water. The detection of metallic poisons and of certain war gases however requires the use of special methods.

The first use of gas by the enemy must be reported without delay.

In this connexion moreover it will be realized that information which may point to the likely use of gas will always be of great value.

Careful reporting of the gas situation may enable the General Staff to make an accurate forecast of what the enemy is going to do next.

It is apparent, therefore, that the early recognition of these substances is of the first importance.

Civilian water authorities also appreciate these dangers and are taking special steps to combat them: the possibility of sabotage and the contamination of open reservoirs with cultures of pathogenic organisms has also to be borne in mind.

If a campaign is sufficiently static, reconnaissance for the arrangement of the water supply is carried out by the Royal Engineers and the water provided and purified by them and made available at centralized water points. Where adequate local sources do not exist, then such water points must be supplied with water which has been transported by land, sea or air from an Initial Water Point, established in the rear.

If on the other hand operations are mobile, and units are detached, such

reconnaissance is made by the regimental authorities and the water dealt with under unit arrangements.

In both cases advisory responsibility with regard to source and purification rests upon the Medical Services. While hygiene officers with larger formations are specially qualified in this work, regimental medical officers also have an important responsibility in this connexion, just as they have in so many other ways.

In both cases also, a *preliminary* analysis of water from any proposed source is imperative.

This analysis may be regarded as the first safeguard against the presence of poisons and other harmful impurities.

Expert knowledge is not essential and all R.E. officers engaged in water supply work as well as medical officers should be able to carry it out.

The *preliminary* analysis is concerned with the physical characteristics of the water, the possible presence of poisons, the quantity of water sterilizing powder required and in certain circumstances the suitability of the water for sedimentation with a coagulant.

The turbidity, colour and odour may be valuable pointers in the first instance to the likely existence of various kinds of contamination. A turbid water, for example, in addition to imposing considerable strain upon filtering equipment, increases the potential risk of liquid mustard gas contamination, a risk which could be reduced were another source to be selected in which passive sedimentation had taken place.

Pre-sedimentation will become necessary in those cases where, as with the waters of the Nile during flood, so much suspended matter is present that filters would rapidly become choked if the raw water were presented directly to them.

Such additional procedure will necessarily cause delay in the production of a safe drinking water.

The odour from a particular water may become noticeably more unpleasant when it is slightly heated.

It can be taken for granted that the chlorine demand of a coloured water will be greater than that of a clear water. Colour will be of particular importance if any special dye is in use for the marking of poisoned sources.

Tests for the presence of poisons are made by the use of the case, water testing, poisons (Poisons Box) which is issued to units on the scale indicated in Regulations for the Medical Services of the Army.

The case and its contents are to be obtained from Medical Mobilization Stores, or from Advanced Depot of Medical Stores in the field.

It is to be noted that a Field Hygiene Section is allotted four Poisons Boxes.

The amount of water sterilizing powder (W.S.P.) that it will be necessary to add, in order that an adequate residue of chlorine may persist in the water for the necessary contact period, is estimated with the aid of the case, water testing, sterilization (Horrocks' Box).

This calculation is not a test of the bacterial purity or impurity of the water but is made in order to determine, since W.S.P. is going to be added to the water in any case, the minimum amount of such powder that will be required.

This box also is a medical supply.

The use of the Horrocks' Box moreover enables the chlorine absorption figure of the water to be stated to the nearest part per million, provided that the W.S.P. contains its full 25 per cent of available chlorine. This figure will prove useful to the R.E. if chlorination by other means than the use of water sterilization powder is to be employed.

It should also be particularly noted that the deviation of large quantities of chlorine as shown by the Horrocks' Test is suggestive of the presence of mustard gas while, on the other hand, the persistence of chlorine in a representative sample is proof of its absence.

While chlorine gives a blue colour in the presence of an iodide and starch solution, owing to the liberation of iodine, mustard gas itself and its product in water—thiodiglycol—are unable to do this.

The value of the Horrocks' Test is considerably enhanced by this use to which it can be put.

A Horrocks' Box is allotted to each Water Tank Truck and Trailer and in certain cases to each Portable Filtering Apparatus: a box is allotted to Field Companies and Field Squadrons R.E. for reconnaissance: four boxes and twelve bottles of the Cadmium Iodide and Starch indicator solution are allotted to each Field Hygiene Section: one box to each M.A.C.

This completes the preliminary analysis so far as the regimental medical officer is concerned.

An engineer officer, however, in the case of temporary large scale supplies, still requires to know something of the acidity or alkalinity of the water for purposes of sedimentation. This may only be ascertainable by simple trial and error with the coagulant to be used. If possible, however, it should be more precisely determined by the use of alumino-ferric, for example, together with lime and brom thymol blue indicator powder. The use of this indicator is particularly suited to alum precipitation. Its pH range is from 6 at which point it is yellow to roughly 8 at which point it is blue. It is *green* at the intermediate pH of 7, which is the optimum pH value for alum precipitation.

Complete analyses are only called for in the case of permanent or semi-permanent water supply work and in those instances in the field in which a particular source has come under suspicion following the use of the Poisons Box. The Mobile Hygiene Laboratory is staffed and equipped for the carrying out of such chemical and bacteriological examinations and other more elaborate investigations and so provides a ready record and reference for hygiene officers with formations, which will be of the greatest value.

But, as already stated, it is the use of the Poisons Box itself which is to be regarded as the first line of defence against poisons in water.

It is, therefore, necessary that skill in its manipulation and confidence in its performance at all times should be instilled into the minds of those who have to use it.

The issue of Poisons Boxes to medical officers is worse than useless if they do not fully comprehend their use. A whole regiment might quite easily be poisoned and perhaps some important post taken owing to the lack of skill shown by the medical officer. The Adjutant-General holds the Medical Services responsible in this respect; if they are, they must be as fully competent to carry out the test as any other medical duty.

CASE, WATER TESTING, POISONS.

There are four main tests to be considered.

The *first* test is the sulphide test for heavy metals.

Very small quantities of lead, copper, mercury and bismuth can be shown in this way.

But arsenic and antimony can only be demonstrated if present in larger amounts.

For example, lead can be recognized by this test down to 2 or 3 p.p.m. (1 p.p.m. if a control is used).

At these concentrations a faint brown colour only is visible: care has to be taken to distinguish this from the white haze associated with an old solution of sodium sulphide.

The safety limit of lead in water is 1 p.p.m. for not more than a week.

Arsenic can be recognized by the test down to 10 to 15 p.p.m. only, that is above the safety limit of arsenic in water which may be set at 5 p.p.m. for short periods and 1 p.p.m. for long periods.

The effect of arsenic on the human body would appear to be far from entirely harmful if the following reference by J. F. W. Johnston (1855) to the Styrian arsenic eaters is true—"Arsenic is consumed chiefly for two purposes—first, to give plumpness to the figure, cleanness and softness to the skin and beauty and freshness to the complexion. Secondly, to improve the breathing and give longness of wind, so that steep and continuous heights may be climbed without difficulty and exhaustion of breath. Both these results are described as following almost exactly from the prolonged use of arsenic either by men or animals."

The sodium sulphide 20 per cent solution bottle as at present issued contains "aq. dist. only" and a note to that effect is made on the card of instructions issued with the case. Sodium sulphide, which is provided in solid form, must therefore be added to the solution bottle.

The same steps are to be taken in making up the ferrous sulphate 25 per cent solution.

A rough check on the contents of these two solution bottles can at any time be made by adding a drop from each bottle to some water in a test tube: a heavy black precipitate of ferrous sulphide is formed.

The *second* test is concerned with the detection of arsenic in small quantities and it is therefore necessary that reagents and apparatus should be shown to be free from traces of this substance before proceeding to carry out the test.

Arsenic may be deliberately added to water by the enemy in the form of a soluble arsenical salt such as sodium or potassium arsenite (sheep dip). It was alleged that in 1915 wells in South West Africa had been poisoned by the Germans in this way.

Poisoning may result from the use of the Nose Gases—D.M., D.A. and D.C. These are toxic smokes containing arsenic in particulate form. Various kinds of mortars have been used for firing bombs containing these gases: shell holes may be heavily contaminated. D.C. also contains cyanide.

Water may be contaminated with lewisite, which although rapidly hydrolysed and its vesicant properties destroyed, nevertheless gives certain arsenical products to the water. It has been stated that lewisite oxide is more poisonous to human beings than arsenious oxide.

The dropping from the air of the dark grey powder calcium arsenide has been thought to be a danger owing to the evolution of arsine (arseniuretted hydrogen) when the powder comes in contact with moisture.

Arsine may itself be used as a non-persistent charging in shell and bombs. It is important to remember that this gas may have little or no smell. It is non-irritant to the eyes, nose, respiratory passages and to the skin. After absorption through the lungs into the blood, it causes hæmolysis of the red blood cells, the pigment being excreted by the kidneys with hæmoglobinuria or by the liver causing subsequent jaundice. The respirator (Container, E vi, which is red), gives 100 per cent protection.

The chief practical importance attaching to this gas lies in the fact that its production in a modification of the Marsh Test serves for detecting minute quantities of arsenic.

Arsenic can by this test be detected down to 5 p.p.m.

Arsenic-free zinc and hydrochloric acid are used to generate nascent hydrogen. A solution of hydrochloric acid diluted with an equal volume of water would perhaps be more serviceable in the Poisons Box. It would cause a more gradual evolution of hydrogen and less harm to metal hinges, etc., from fumes of hydrochloric acid would result.

When arsenic-contaminated water is added, arsine is formed under the influence of nascent hydrogen. When the gas is kindled and allowed to impinge on a piece of white porcelain, a black stain of metallic arsenic is deposited: this is insoluble in dilute hydrochloric acid. Arsenic is soluble in a solution of sodium hypochlorite, antimony is not.

This use of the Marsh Test in the field has been criticized on the grounds that the flame may be difficult to keep alight and that the porcelain tile frequently gets broken. It is doubtful whether either of these criticisms is entirely justifiable. The following tests have at different times been put forward as alternatives to the Marsh Test.

In the *Gutzeit* test, nascent hydrogen and arsine are generated in a similar way. Instead of the gas being kindled however, it is made to pass through filter paper impregnated with mercuric chloride or bromide. If arsenic is present, stains varying from pale yellow to dark brown are obtained owing to the formation of mercuric arsenide. As similar staining may also be produced by sulphur dioxide and sulphuretted or phosphoretted hydrogen, the evolved gas may be allowed to pass through lead acetate granules in which these gases are absorbed. If this method were to be incorporated in the Poisons Box, it would be necessary to abolish the use of sodium sulphide solution in the first test.

The *Reinsch* Test consists in boiling for three minutes some of the suspected water with a piece of pure copper foil and some hydrochloric acid. A steel grey coating on the copper shows the presence of arsenic. It is less satisfactory than the previous tests since other metals besides antimony interfere.

By none of the above three tests can organic arsenic in water be detected and, if suspected as in the case of lewisite or the nose gases, must be converted to the inorganic form by boiling the sample with a little caustic soda before testing.

In the *third* test, cyanide is detected by the formation of Prussian blue (ferric ferrocyanide) in the presence of acid. Caustic soda is first added in order to form sodium cyanide. Ferrous sulphate is then added followed by thorough boiling. After cooling, just sufficient hydrochloric acid is added to neutralize excess caustic soda which would decompose the Prussian blue.

Cyanide can be detected by this test down to 20 p.p.m. For short periods of consumption 45 p.p.m. is the safety limit in water.

One of the nose gases, viz. D.C., contains cyanide in addition to arsenic.

The *fourth* test is the iodo-platinate test for the detection of mustard gas.

It depends upon the fact that, although mustard gas will *not* liberate iodine from potassium or cadmium iodide, for example, it will do so from the more loosely combined iodate of potassium and platinum. The iodate is in fact reduced to the iodite and iodine thereby liberated. Thiodiglycol, the hydrolytic product of mustard gas, acts similarly. The test would be of much less value if this were not so.

As, however, chlorine and nitrites also give the iodo-platinate reaction, it is necessary to take steps first to destroy either of these substances which may be present in the sample. This is done by boiling with urea and hydrochloric acid. In an emergency one inch of fresh urine has been used with success in place of the urea tablet.

Thiodiglycol is not destroyed by this treatment and, if present, is shown by the appearance of a blue colour on the completion of the test. The potency of the starch and salt solution used in the test may be checked by adding a few drops, together with a few drops of the iodo-platinate solution, to some water in a test tube known to contain free chlorine; a blue colour should be obtained.

WAR GASES AND WATER SUPPLIES.

In considering the effect of the war gases on water it is convenient to make use of the tactical classification of such substances into non-persistent gases and persistent gases. In general water supplies will not be affected by the non-persistent gases. No special treatment will be necessary for the purification of water affected with, for example, a lachrymator such as C.A.P. or choking gases such as chlorine, phosgene and diphosgene.

The nose gases however, although classified as non-persistent, may require special consideration owing to the possibility of arsenical contamination of water in shell holes.

The effect of the persistent gases on water supplies is of great importance.

A persistent lachrymator such as B.B.C. and possibly also K.S.K. may render a water supply unusable and unapproachable for many days. The persistent choking gas—chloropicrin—may also make a supply temporarily unusable owing to its associated lachrymatory action.

It is the contamination of supplies with the blister gases however that may constitute a military hazard of great importance.

Lewisite ("Dew of death", chlorovinyl dichlorarsine) is readily hydrolysed and its blistering action thereby destroyed but arsenical contamination of the water results—and this must be recognized and removed before the water can be drunk. Lewisite remains a liquid at much lower temperatures than does mustard gas; freezing point—lewisite 9° F., crude mustard 45° F., pure mustard 58° F. Its employment in cold climates or seasons therefore is to be expected.

Detectors turn red where in contact with the liquid.

Mustard gas (Yellow cross. Yperite. Dichloro diethyl sulphide) is a heavy oily liquid only very slowly hydrolysed so that its vesicant power persists.

It is soluble in water to about 0.1 per cent.

Detectors turn red in contact with the liquid.

In a contaminated supply there may be a slight film of liquid mustard on the surface, some dissolved mustard in the middle water and liquid mustard in bulk at the bottom.

The hydrolysis products, which are formed so slowly, are hydrochloric acid and thiodiglycol, both of which are in ordinary circumstances practically harmless.

It is essential that water contaminated with mustard gas should if possible not be used for drinking or ablution purposes. However, if no alternative source is available, it is necessary to consider how the risks involved in its use may be reduced to a minimum.

If sufficient time has elapsed since the water became contaminated, if the nature of the source is such that passive sedimentation can have taken place and if the method of withdrawal of the water is to be by means of a strainer floated some 6 to 9 inches below the surface, then it is a reasonable presump-

tion that the water delivered will contain at the most a certain amount of *dissolved* mustard gas.

This water may be filtered in the ordinary way in order to remove suspended matter and then passed into the tank of a water vehicle. It is then allowed to stand if possible for two hours when the Horrocks' Test is performed and the water sterilized preferably by superchlorination.

For the reasons already given, the carrying out of the Horrocks' Test on such an occasion is an added safeguard against liquid mustard gas contamination.

On the other hand, if the factors already referred to are all unfavourable and the source is a shallow one, then water obtained is likely to contain *liquid* mustard gas. Circumstances must be extremely grave before the use of such water can be contemplated.

Oily globules of liquid mustard gas are not removed by service *pressure* filters of the cloth type using clarifying powder (Alum) or of the metal filter type using filter powder (Kieselguhr). If the source has to be utilized, a bucket can be employed care being taken not to disturb the bottom.

The water can be made safe by boiling for half an hour.

The hydrolysis products are innocuous but may be somewhat unpalatable.

In some cases it may be found practicable to remove liquid mustard gas from a surface source by improvising a method of slow *gravity* sand filtration—a method which does in fact hold back the oily globules.

An excavation is made a short distance away and the water which filters into it will contain dissolved mustard gas only which can then be dealt with in the manner already described.

The special methods to be adopted for the removal of poisons from water are the concern of those chemists who are specially appointed for this duty.

Wherever mobile equipment is used for the purpose it is desirable that such mobile water depoisoners should also be capable of being used for routine purification processes. It cannot be considered practicable to decentralize methods of poison removal for use under regimental arrangements. Large-scale methods under the direct supervision of a skilled and specially qualified chemist are therefore more likely to be employed in the field by the Royal Engineers.

My thanks are due to Colonel E. B. Allnutt, *M.C.*, for forwarding this article for publication.

AN EXTRA-DURAL ABSCESS WITH SOME UNUSUAL FEATURES.

By MAJOR DAVID H. CRAIG,
Royal Army Medical Corps.

PRIVATE C. C., aged 23. In the Army six months. A gardener in civil life. Admitted 10.2.40.

History.—Stated to have been ill for eight days with a severe cold, during which he had a very profuse purulent discharge from the left nostril and complained of pain over the left cheek, which was stated to have been swollen and tender. The left ear had been noticed to have been discharging for about a week. On the evening of 9.2.40 his temperature which had been sub-normal rose to 102·2° F.; he made no complaint. At 10 a.m. on 10.2.40 he became unconscious and was admitted to the E.N.T. Dept. here at 12 noon.

On Admission.—Well nourished male in a stuporous condition. Cannot answer or apparently understand questions. The left cheek is swollen and apparently tender and there is slight œdema of the lower eyelid. There is a fairly profuse purulent discharge coming from the region of the middle meatus of the left nostril. There is a profuse purulent discharge from the left ear with pronounced sagging of the meatal wall so that the drum cannot be seen but no œdema or apparent swelling of the left mastoid prominence.

Neck stiff. Kernig positive. Incontinent urine. K. J. not elicited. Plantars ↓. Abd. reflexes present and equal on each side of the abdomen.

10.2.40. *At Operation.*—Lumbar puncture: 30 c.c. purulent fluid withdrawn under more than 200 mm. pressure. Total cell count not done, report "very many disintegrating pus cells."

Sterile on twenty-four hours culture.

Nasal Swab.—Sterile on twenty-four hours culture.

Mastoid air cells full of thin sero-pus. Antrum full of septic granulation tissue and pus. Bone of tegmen unhealthy and necrotic and, when the dura of the middle fossa was exposed, more than an ounce of thick yellow pus was evacuated. The necrotic bone overlying the dura was removed so as to expose an area of dura rather more extensive than a half-crown. The dura was covered by granulation tissue and did not pulsate. In order to remove all the necrotic bone, the bridge and the lateral wall of the attic region were taken down. The contents of the middle ear were disturbed as little as possible.

The wound was packed with hypertonic saline and left open.

(Pus from extradural abscess *Pneumococci* ++.) 4 grammes M & B 693 given intramuscularly and 1 gramme ordered t.i.d.

11.2.40.—General condition is now better. Temperature 102·4° F. Pulse rate 116. Respirations sighing and irregular and the patient still is incontinent but can now understand simple instructions and will co-operate, e.g.

opens mouth when told to do so and swallows well. Dressing changed. Meatus dry and wound cleaner.

Lumbar puncture: Pressure of fluid not now raised. Quite clear.

Sterile on twenty-four hours culture. Reported as containing a few mature polymorphs.

12.2.40.—Wound much cleaner. Temperature normal. Neck less rigid. He is still incontinent but seems much brighter.

13.2.40.—The patient can answer simple questions though rather slowly but is still incontinent. Breathing is now regular and has lost the sighing quality. Wound dressed with B.I.P.P.

Very little discharge from the nose to-day.

14.2.40.—Improvement seems to be maintained. Still incontinent.

16.2.40.—Incontinent, but a good deal brighter. Showing definite nominal aphasia to-day. Calls a spoon a clock. Says he "has no pain" and "that he cannot remember names."

19.2.40.—No incontinence this morning. Answers questions quite readily and fairly quickly. Still shows nominal aphasia, says he cannot remember names of objects and realizes his mistake correctly describing their use.

White cell count, 16,000. M & B omitted.

20.2.40.—Fairly alert mentally this morning and co-operates readily when being dressed. There is still some purulent discharge from the mastoid wound, the meatus remaining dry. The dura is pulsating this morning.

22.2.40.—No nominal aphasia this morning. Readily remembers names. Wound cleaner.

8.3.40.—Up.

This man was admitted during the height of the cerebrospinal fever outbreak and presented a problem from a diagnostic point of view partly on that account since his meningitis might have been due to cerebrospinal fluid, arising in consequence of his infected maxillary antrum or as a consequence of the mastoid infection.

The diagnosis of acute mastoiditis was made with confidence in view of the sagging meatal wall which is a sign of great reliability in mastoid infection even in the absence of the more commonly noted local signs of pain, tenderness and œdema over the mastoid prominence.

The sequence of events is also of interest in that the original source of infection was presumably the antrum infection arising in consequence of the acute coryza, and tracking *via* the eustachian tube or peri-eustachian lymphatics to the middle ear.

The local defences in the nose were apparently more efficient than in the ear since the infecting organisms could not be recovered from what was presumably the primary source of infection.

The absence of organisms from the cerebrospinal fluid, which, as has been pointed out by Stewart and others, may be suggestive of a hopeful prognosis is worthy of note. Other features of interest are:

The rapid return of the cerebrospinal fluid to normal when the extradural abscess was evacuated.

The presence of well marked nominal aphasia apparently arising owing to pressure on, or œdema of the temporo-sphenoidal lobe, an unusual finding since aphasia usually results from a parenchymal involvement of the cerebral tissue rather than pressure from without. The prompt clearing up of the nominal aphasia when the circulation of the temporo-sphenoidal lobe returned to normal, as indicated by the dura beginning to pulsate again, must be emphasized.

The optic discs remained normal throughout and it was not possible to demonstrate any impairment of the visual fields.

I am indebted to the late Lieutenant-Colonel Spong, R.A.M.C., O.C. Military Hospital, for permission to record this case.

REFERENCE

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CLINICAL MEMORANDUM ON TINEA INFESTATION.

BY CAPTAIN P. NOEL-HANSON,

Royal Army Medical Corps.

INTRODUCTION.

Tinea cruris (inguinale), Dhobies Itch, has for some years been endemic in England and in the early part of 1940 a large number of men in these Divisions contracted the disease possibly from contact with troops coming from the East. It has been ascertained that to date at least 40 per cent of the strength of this unit has contracted the condition in some form especially the forms associated with *Ectothrix trichophyta* and *Epidermophyta*.

Total number of cases treated here since December 1, 1940, to January 12, 1941, is 190. Total number of cases showing complications: 21 (11 per cent), (a) dermatitis 15 (7·5 per cent); (b) recurrences 6 (4 per cent).

It was noticed that only about 10 per cent of the total number of men infested complained of irritation and discomfort although in some cases the rash was severe. The men were mostly between the ages of 20 and 30, and the infestation had been present for varying periods of time (three to twenty-eight days). It was confirmed that the incubation period was in the region of five to seven days.

DIAGNOSIS.

Clinically there are apparently two forms of *tinea* infestation; they seem to be quite distinct and intermediate manifestations were extremely rare. The forms are:

(1) *Acute*.—This occurred often in *tinea cruris* but was mostly observed in cases of *tinea interdigitale*. The area was moist and raw and very inflamed, mostly on the margins on which were many large papules with a tendency to become pustular.

(2) *Subacute*.—Seen most frequently in *tinea inguinale*. The margin was pinkish and exhibited macules of the same colour with very few tending to become papular. Fine desquamation of the epidermis occurred over the entire affected area and closer examination revealed some degree of lichenification.

In some atypical cases careful investigation should be made to differentiate *tinea* from (a) *seborrhea corporis*; (b) psoriasis; (c) parapsoriasis; (d) pityriasis rosea; (e) discoid eczema; (f) circinate impetigo; (g) tertiary syphilis.

TREATMENT.

After having given up treatment of patients with Whitfield's ointment, Castellani's Paint and Pulv. Americana between July and November and

having found that, although the treatments with the last named were successful, cures were not effected under fourteen to twenty-eight days (Adamson's method of treating with 2 to 4 per cent silver nitrate followed by tincture iodi fort, a silver iodide being formed and which is said to cure the condition in twenty-four hours, has not yet been tried in this battalion) the effect of treatment was tried with

Di-oxy-anthranol	0.5 per cent
Salicylic Acid	2.5 per cent
Paraff : Moll : Flav	97.0 per cent.

Di-oxy-anthranol (Cignolin-Bayer, Derobin-Glaxo Ltd.) has been suggested by Roxburgh in 2 per cent dilution. I found that such a concentration caused an immediate dermatitis and the above prescription was used instead.

Within a few hours after inunction with the above-mentioned prescribed ointment, the effected part becomes dark brown in colour and an erythema is produced in the surrounding and central area, with a sharp almost black line of demarcation showing the outer limits of the advancing mycelium. When the treatment has reached its optimum value, the advancing line becomes clear-cut in appearance and the raised papules, now reddish-brown, become flattened and diminish in size. Should too much or too strong a preparation have been used, a secondary erythema is produced which is the development of macular patches, not only on the edges of the lesion but in the central and surrounding areas. It is stressed that the patient should be examined very frequently during the period of treatment to determine when the treatment should be discontinued and to watch for a developing secondary irritative superficial dermatitis.

In this limited number of cases it was found that between four to five treatments, i.e. a period of between thirty-six to forty-eight hours, is sufficient to effect a cure, any variation of the results depending on the individual (*vide infra*).

COMPLICATIONS.

A diagnosis of *dermatitis* is made only when lymph nodes are palpable. It is liable to occur when:

- (1) too much of the preparation has been used either accidentally or for the reasons stated below.
- (2) there is present an idiosyncrasy—thin highly vascularized skins, men subject to hyperidrosis.
- (3) the weather or exertion causes free perspiration.
- (4) the infestation has been present for a long period of time, e.g. six weeks or more.
- (5) the treatment has begun after previous attempts to cure with other irritant preparations.

The condition is one of *tinea interdigitale* and acutely inflamed *tinea corporis (circinata)*.

Where the above conditions exist, special attention must be paid in order

to prevent the complication. Generally no more than one treatment each day with the ointment may be given and all excess removed. It has been found better, even at the risk of recurrence, to stop the treatment earlier than the third occasion, keep the patient under observation, and to continue later if necessary. Should any signs of dermatitis in the central area develop, this should be treated with lotio calaminæ co. (It has been found very good policy to do this in all cases where there are any signs of strong reaction to the drug.)

Treatment of Dermatitis.—After having tried several preparations for the dermatitis following the treatment of *tinea inguinale* it has been found that daily application of crude coal tar 1 drachm to Lassar's Paste 1 ounce clears up the condition in two to four days; olive oil is used for cleaning up the area. This method can also be used in such complications following *tinea axillaris*.

Alternatively the area is painted with a solution of 0·5 to 1·0 per cent gentian violet or alcoholic picric acid 2·5 per cent.

Tinea interdigitale should not be treated with di-oxy-anthranol as it has been found that every case so far treated with this preparation has developed a dermatitis. In this battalion it has been found to respond best to frequent bathing in strong warm solution of potassium permanganate, 0·5 per cent, drying thoroughly with methylated spirits and keeping the toes well apart by inserting pads of cotton-wool (powdered with talc and boracic—lamb's wool has been unobtainable so far). Good results are said to have been obtained with metaphen (Abbott) in collodion.

DISINFESTATION.

The ideal procedure would be:

(a) complete disinfestation of all clothing, bedding and personal belongings.

(b) complete isolation (rest in bed is only necessary in very acute cases) accompanied by active treatment as set out above. In the Sick Bay at this unit, immediately a man is discovered to be suffering from *tinea* he is detained and all his clothing, bedding and other property is removed and sent to the disinfestor. He is then issued with a clean pair of pyjamas, hospital blues, socks, shoes and blankets for use when under treatment. His disinfested property is kept until he is to be discharged. On discharge those articles issued to him whilst in the Sick Bay are removed and sent to the disinfestor at our own convenience; the main advantage being that the discharge of the soldier from the Sick Bay is not dependent upon the irregular functioning or the vagaries of the disinfestation plant. The soldier is then instructed to present himself for observation at two to four days' intervals until finally discharged.

During the period of observation it is advisable to recommend that the patient is kept on light duties and everything must be done to avoid macera-

tion of the recently treated part by perspiration, etc. After discharge he is advised to keep the area dry and clean.

DIFFICULTIES AND ERRORS IN THE ERADICATION OF THE INFESTATION ARE:

- (1) Incomplete and perfunctory examination by the Medical Officer to exclude possible autoinfection from an undiscovered area in the same individual.
- (2) Technical errors in disinfection in that some small quantities of the mycelium and/or spores remain viable.
- (3) Transfer of spores from infested clothing during laundering.
- (4) Difficulties in organizing inspections of a unit during the limited period of one or two days. Sometimes as much as a week or more elapses before a company is inspected and hence men not examined, suffering from *tinea*, in the meantime infect others who were free on inspection. Added to this there are some men whose duties make it almost impossible for them to attend some of the inspections.
- (5) Absence of men on inspections who find some excuse on principle or consider that they are personally excluded for some reason of their own.
- (6) Men who develop the condition between inspections but do not report.
- (7) Men in whose mind *tinea* is associated with lack of personal hygiene or venereal disease. These men do not report immediately and infect numbers of other men until they themselves are discovered during the routine inspections.

In view of the difficulties mentioned above lectures on the subject were given separately to officers and men, and instructions given in battalion orders stressing among other things—(a) the effect on efficiency of personnel infected with this disease and (b) its non-relationship with venereal disease.

SUMMARY.

- (1) To diminish the length of time of treatment a preparation has been made with apparently useful results.
- (2) Methods of treatments have been outlined and reference has been made to the treatment of complications.
- (3) Reference is made to treatment of *tinea* infestation under conditions simulating active service and having regard to such difficulties as exist in an infantry battalion.
- (4) Some stress is laid on the manner of dealing with the attitude of the average soldier to the infestation.

There is no mention of other means of treatment which are impracticable in an infantry battalion on active service.

Editorial.

THE MILITARY IMPLICATIONS OF PSYCHIATRY.

IN 1922, the Southborough Committee—whose report, it has been suggested, should be in the knapsack of every potential D.D.M.S.—surveyed the psychiatric problems of the last war.¹ How little the nature of these problems was understood at the time can be realized from the designation “Shell Shock.” Medical and combatant officers alike indiscriminately grouped under this journalistic heading cases of psychosis, psychoneurosis and instability occurring in high-grade mental defectives. In the words of the Committee, “the psychological determinants were largely disregarded, save in cases of complete nervous exhaustion or gross mental breakdown.” The true origin of psychiatric disability was seldom recognized and “owing to the materialistic trend of modern scientific medicine, it was attributed to a physical origin comparable to that inferred in cases of actual concussion of the central nervous system.”

In the United States, however, the situation was different. Dr. T. W. Salmon's report to the U.S. Surgeon General on his survey of the “Shell Shock” problem in the British Army showed, for its period, a penetrating insight into the origin of the problem which enabled the U.S. Army in their mobilization of 1917 to profit from our experience in the previous three years.

We profited little ourselves, even in knowledge, until the Southborough Committee, having sifted the evidence of combatant officers and medical witnesses, produced a series of recommendations, nearly all of which have the whole-hearted approval of informed psychiatric opinion, even after twenty years.

The small number of officers who had acquired psychiatric experience at “D” Block, Netley, represented the total specialist personnel of the R.A.M.C. in this field of medicine at the commencement of hostilities. Consulting Psychiatrists were appointed to the B.E.F. and to the Army at home on the outbreak of war. A small staff followed the former abroad. At home no other psychiatrists were appointed until April, 1940. The nature of hospitals in France rendered psychiatric work essentially similar to that of the Army at home, while the subsequent evacuation meant that the problems of Dunkirk were largely dealt with in this country, and treatment of evacuated military psychiatric cases, other than gross psychotic disorder, was carried out in this country by the E.M.S.

If the medical needs of the Army were limited to the in-patient treatment of the sick and the assessment of the condition of those about to be dis-

¹ Report of the War Office Committee on Shell Shock, 1922, His Majesty's Stationery Office.

charged such a civilian service might have sufficed. But it rapidly became clear that the lack of military psychiatrists was having unfortunate consequences; E.M.S. Psychiatric Centres, for instance, were receiving, on the one hand, many chronic cases whom no amount of treatment could bring to a standard of military fitness and, on the other, cases for which no more was needed than advice to a medical officer on the handling of the simpler psychiatric problems.

In April of 1940 a psychiatrist was attached to the Medical Headquarters of each Command. Military out-patient departments were set up and these were able to act as a filter for E.M.S. Hospitals, separating out those cases which were most likely to recover if retained in their own unit under the supervision of their medical officer. This out-patient work necessitated the appointment of further military psychiatrists to each Command towards the end of 1940.

It was not to be expected that the Army would react to psychiatry and its implications in any way differently from civil medicine. Every man and particularly every doctor is in some sense of the word a psychologist; and so the position of a psychiatrist differs considerably from that of other specialists. Just as, in civilian life, the general practitioner, the public and the administrative authorities were the first to grasp the enormous potential scope of modern psychiatry, so in the Army, from the beginning, the Commanding Officer, Company Officer and the Regimental Medical Officer were the first to realize the possibilities of this aspect of medicine. Difficulties, however, there certainly were; and many of them will be commemorated in the half-friendly, half-doubtful nickname of "trick-cyclists," which was bestowed on psychiatrists at an early date!

In early 1940 psychiatric work was largely diagnostic; but the position of psychiatric diagnostic facilities does not by itself implement the recommendations of the Southborough Committee which may be summarized under three headings—recruiting, the clinical handling of individual cases and prophylaxis.

The Committee stressed the importance of eliminating cases of potential psychiatric disability at the recruiting stage—particularly since they were convinced that in the last war "a great number of men who were ill-suited to stand the strain of military service, whether by temperament or their past or present condition of mental and nervous health, were admitted to the Army." Military psychiatrists have not, of course, taken any part in devising the present recruiting procedure which is controlled by the Ministry of Labour and National Service. Nevertheless, their experience could prove valuable to those responsible for recruiting procedure and it is hoped that it may be made available to the appropriate body.

The clinical handling of many individual cases in the earlier part of this war left much to be desired—certainly acute neuroses occurring in the battle of Flanders were sometimes left to languish for long periods in general hospital beds under an organic label with no other treatment but a placebo:

and it is equally certain that psychiatrists were at times over pessimistic in their assessment of a man's military fitness. Their pessimism may sometimes have been justified by the difficulty, which at that time existed, of arranging for a man who was only capable of a limited psychiatric adjustment to be transferred to a type of employment or duty likely to give him the best chance of recovering or retaining his adjustment to Army life.

In this field of transfers, after much discussion, the systems of personnel selection commonly employed in civil life and in some armies, found expression in the new Directorate for the Selection of Personnel, which was formed in June, 1941. The bulk of Intelligence Testing and action to fit the recruit into the best available job is now undertaken by this Directorate, while personality and "misfit" problems of various types form an increasing part of psychiatric work. The introduction of efficient methods for the transfer of the psychiatric misfit has probably played as large a part in the reduction of the rate of psychiatric invaliding as have improvements in psychiatric treatment.

The prophylactic recommendations of the Southborough Committee cover a wide field. They emphasize the overlap between morale, welfare and discipline and their effect on the mental health not only of individual men but of units. The mental health of the Army depends not only on its specialists. Its junior combatant officers must carry most of the burden.

The psychiatrist and the regimental medical officer are the advisers of the combatant officer. Psychiatric disability can only be prevented, or diagnosed in time for short treatment to be successful, if this triple co-operation is close. The true prophylactic psychiatry is "man-management" and if this is to be successful the medical and combatant officers' care of their men must go further than the "stable management" of grease traps, billets and food, important as they are. In modern War, given anything like equality of arms, morale and discipline are the determining factors. Psychiatrists insist that it is most useful to think of morale as the will to win, something which grows by day-to-day contact between men and between officers and men, while discipline is respect of military law. It is in the field of morale that the psychiatrist and medical officer can be of most help to their combatant colleagues. It is by psychiatric advice in planning of scientific man management, and by help to combatant and medical officers in carrying it out, that the military psychiatrist can probably make his greatest contribution to prophylaxis—especially if he realizes that he himself must also learn and keep on learning from the combatant, medical and administrative officers with whom he co-operates.

A LETTER TO HER MAJESTY THE QUEEN FROM THE
COLONEL COMMANDANT OF THE ROYAL ARMY MEDICAL
CORPS AND HER MAJESTY'S REPLY.

*The Private Secretary to
Her Majesty The Queen,
Buckingham Palace,
London.*

SIR,—As Representative Colonel Commandant, I beg to request that you be so kind as to present my Humble Duty to Her Majesty The Queen, and to express to Her Majesty on behalf of all ranks of the Royal Army Medical Corps our pride and joy in the great honour bestowed upon us by Her Majesty's gracious assumption of the appointment of Colonel-in-Chief of the Corps in succession to our late beloved Colonel-in-Chief His Royal Highness The Duke of Connaught.

We are well aware of Her Majesty's great interest in all matters relating to the welfare of the sick and wounded, and this special honour will be an additional encouragement to us to do our utmost for the sick and wounded of His Majesty's Forces wherever they may serve.

I am, Sir,

Your obedient servant,

(Sgd.) JAMES A. HARTIGAN,
Lieutenant-General (Retd.)
Rep. Col. Commandant
Royal Army Medical Corps.

*Officers' Mess,
Royal Army Medical Corps,
Millbank, S.W.1.
February 25, 1942.*

*Lieutenant-General Sir J. A. Hartigan (Retd.),
K.C.B., C.M.G., D.S.O.*

MY DEAR GENERAL,—The Queen commands me to express her thanks for your letter of February 25, sent on behalf of All Ranks of the Royal Army Medical Corps, and to say that Her Majesty greatly appreciates the terms in which you refer to Her appointment as Colonel-in-Chief in succession to His Royal Highness the late Duke of Connaught.

The Queen sincerely welcomes the position she now assumes; the record of skilled and unselfish service for which the Corps is famed is of course well known to Her Majesty.

I am to say that The Queen will be glad to be kept informed of any matters affecting the interests of Her Corps, and to assure you that these will always be a matter of personal concern to Her Majesty.

Yours sincerely,

(Sgd.) ARTHUR PENN,
Acting Private Secretary to The Queen.

*Buckingham Palace.
March 5th, 1942.*

Clinical and other Notes.

IMPROVISED METHOD OF VACCINATION.

BY CAPTAIN D. S. DICK,
Royal Army Medical Corps.

THE following method of vaccination may prove useful in Unit M.I. Rooms where the authorized scale of equipment does not include the usual vaccinating knife but only the ordinary issue scalpels which are large and rather unsuitable for the intradermal introduction of calf lymph. It comprises a pair of artery forceps together with a fully curved suture needle.

The suture needle is clamped in the forceps in its middle point and the eye of the needle is used for taking up sufficient lymph from the bottles provided as sufficient for twenty-five persons by the Vaccine Laboratory. It gives a clean application and is economical in that the amount of lymph used can be readily controlled. The point of the needle is used for the intradermal incision and the view of the incision is not interrupted as it is when using a scalpel. It gives an almost pencil-like action and the length and depth of the incision can be accurately gauged and there is no risk of drawing blood or on the other hand of failing to introduce the lymph.

This method has been employed in this unit in over 500 cases and during this time there has not been one instance of a really bad arm and in no case did the subject require to be admitted to Reception Station or Hospital.

The use of a needle for vaccination appears to be quite popular in the Army but the technique may be original. The method is very economical in that one suture needle can be used for at least 100 cases. Also there does not seem to be an easier way of transferring the lymph from the bottle than by the eye of a needle and it is found that many more than the prescribed number, in fact double that number, can be successfully vaccinated with this method.

I am indebted to Colonel R. W. Galloway, *D.S.O.*, Assistant Director of Medical Services, for permission to submit this article for publication.

A REPORT ON A SERIES OF CASES OF SIMPLE ACUTE TENOSYNOVITIS.

BY CAPTAIN H. POZNER,
Royal Army Medical Corps.

Relevant History.—During the first few weeks of September, a company of an infantry battalion was detailed to help in the harvesting. Most of the men were occupied in pitching the sheaves and altogether about seventy

men were employed. After the first day, and up to the end of the week, men were reporting sick and complaining of weakness and pain in their right wrists. An investigation was conducted, and the following information was obtained.

(1) Seven men reported sick with definite symptoms.

(2) Four men complained but did not report sick although the symptoms remained.

(3) Nine men had symptoms, similar in nature to those previously discovered, of such a minor degree as to cause no discomfort or disability.

Clinical Features.—In all cases the right wrist was affected, and the following symptoms were complained of in the order of incidence: (a) A dull ache leading to actual pain in the wrist; (b) weakness of gradually increasing severity; (c) a “creaking” in the wrist and forearm of all the cases who reported sick; (d) swelling in the more severe cases on the dorsum of the wrist.

The first symptom, which was an ache in 80 per cent of the cases, appeared at varying periods from two hours to five days after the commencement of the work. No symptoms of any sort appeared later than five days in any of the cases. Occasionally weakness in the wrist was the first indication of the condition and this was apparent in 15 per cent of the cases. Crepitus, as the first noticeable feature, appeared in only one case. Swelling as a clinical sign was demonstrated in 15 per cent of the cases.

Investigation.—On examination, most of the cases exhibited a slight wrist-drop. In the severer cases there was swelling on the dorsum of the wrist. Extension was painful and tender spots were demonstrated on the dorsal aspect of the wrist-joint over the extensor tendons. Weakness was apparent in semi-pronation. Well-marked crepitus was a feature of nine of the cases, again mostly apparent over the region of the extensor muscles of the thumb. There was no limitation of movement.

Diagnosis.—All these cases were diagnosed as simple acute tenosynovitis.

Treatment.—It was decided to treat these cases by rest and support. In the first four cases, the right hand was supported on a “cock-up” splint made of Kremer wire which was well padded, and the arm was then put up in a sling. In the next three cases a different procedure was adopted. The hand was flexed round a 3-inch roller-bandage and kept in position by an elastoplast bandage which covered the dorsal and volar aspects of the forearm and was secured at the wrist by a supporting band of elastoplast.

This position was maintained in all cases for seven to ten days and then the supports were removed and an ordinary supporting bandage was applied round the wrist. The less severe cases had wrist bandages and were rested.

Prognosis.—The prognosis was in all cases good. It was found that the wrist was not absolutely fit to perform its full functions until three weeks after the first appearance of the symptoms.

Remarks.—In order to get full recovery of function absolute rest was essential for at least one week. In those cases where a compromise was

attempted, and slight exercise was allowed, the results were poor. It is necessary to commence treatment as soon as the condition is diagnosed if there are to be no unfavourable sequelæ. The elastoplast treatment was better than the "cock-up" splint and, in the more severe cases, it is suggested that a plaster splint would have been preferable.

Summary.—Although clinically the condition observed was a simple entity there are a few interesting points.

(1) A surprisingly high incidence of this condition was observed in men employed on the same job: 10 per cent of the men had the condition fully developed. 29 per cent of the total number of men working had features of the disability.

It is probable that these figures do not give an accurate estimate and that the percentages were higher, since some of the men were only employed for short periods.

(2) As the right wrist was affected this meant that at least 10 per cent of the men were not available for weapon training for three weeks. Since many battalions were employed in a similar manner the loss of man-hours from a military-training view must have been considerable.

(3) In those cases which are not treated on firm lines there is the danger of a permanent slight disability.

(4) This condition, which is not normally found amongst the men in training, assumed the role of an occupational disease and could probably be prevented by an elastic wrist support whilst the extensor muscles were being used for some sudden, new function.

THE TENTH BRITISH RECORD OF *ORTHOPODOMYIA*
PULCHRIPALPIS RONDANI. (DIPTERA: FAM. CULICIDÆ.)

BY PRIVATE E. W. CLASSEY, F.R.E.S.,

Royal Army Medical Corps.

WHILST engaged on a survey of the insect fauna of the Hants-Surrey border (to be published in "The Entomologist") and in continuance of the work done on the culicidæ of this area by Major T. T. Macan, R.A.M.C., I was fortunate enough to find a larva of *Orthopodomyia pulchripalpis* Rondani.

The larva was found in one of a series of shallow pools in a birch wood situated about three-quarters of a mile west of Brookwood, Surrey.

The occurrence is remarkable for the following reasons:

(1) *O. pulchripalpis* is an arboreal species and the larva has hitherto been found only in rot-holes in tree-trunks. The only explanation which occurs to me is that the larva may have been floated out from a very low rot-hole by an abnormally high water level or washed out by an exceptionally heavy rain. A sample of the water in the pool was obtained and proved to have a

pH value of 8.1. A larva which *had* been washed from a rot-hole would probably be perfectly happy so long as the water remained alkaline.

(2) The excessive rarity of the species. There are only nine previous records of *O. pulchripalpis* in Great Britain and one previous record from Surrey, i.e. Ripley, 1930, recorded by M. E. MacGregor. The other counties from which it has been recorded are Buckinghamshire, Cambridge-shire (three times), Essex (twice), Hampshire and London, all larvæ; the adult has never been taken in Great Britain.

O. pulchripalpis is an easily recognized species and the following is a description of some of the most obvious characteristics of the species in the larval and imaginal states. (A full and detailed account of all the stages of this insect together with notes on its ecology is to be found in "The British Mosquitoes," by J. F. Marshall, C.B.E., M.A., F.R.E.S., page 258 *et seq.*, published by the British Museum (Natural History) 1938.)

Adult:

- (1) Palps in female nearly half length of proboscis.
- (2) Proboscis with white ring of scales.
- (3) Wing veins dark-scaled except for basal fifth of vein 1 which is ornamented with white scales.
- (4) Leg markings as follows: Fore- and mid-tarsi dark-scaled except for a very narrow white basal ring on first segment. Hind tarsus dark-scaled with white distal and basal rings on segments 1 to 4. 5th segment of hind-tarsus entirely white.
- (5) 4th tarsal segment of fore-legs not longer than broad.

Larva:

- (1) In no instar does the larva possess a pecten; a character which at once separates it from all other British culicidæ.
- (2) Coloration pinkish.
- (3) Conspicuous enlargement of the two main tracheæ within the thorax and 5th to 7th abdominal segments.
- (4) In the first larval instar the mid-frontal and saddle hairs are bifid.
- (5) In later instars the arrangement of the comb-scales is very characteristic. The following description is taken from Marshall: "This (the comb) consists of (i) a posterior row of long scales, (ii) an anterior row of medium scales, and (iii) a row of short scales forming a ventrally-directed extension of the anterior row."
- (6) In the fourth (last) instar the 7th and 8th abdominal tergites bear conspicuously sclerotized patches.

The genus *Orthopodomyia* Theobald is mainly American and *O. pulchripalpis* is the only European species. Strangely enough this species appears to be confined entirely to Europe where it is rare. The continental distribution according to Marshall is Italy, Albania and Russia.

THE PREPARATION OF SOLUTIONS FOR INJECTION AT A CASUALTY CLEARING STATION.

BY SERJEANT J. T. DIXON, M.P.S.,

Royal Army Medical Corps.

MANY pharmacists serving in H.M. Forces in their professional capacity, under war-time conditions, will have been confronted with numerous difficulties in connexion with the preparation of sterile solutions for intravenous injection. To mention only two such difficulties, suitable apparatus and containers for the preparation and storage of the several solutions required are not readily obtainable.

The following extemporaneously prepared sterile preparations are all in use to varying extents at No. — Casualty Clearing Station: sterile water, normal saline, glucose saline, sodium citrate 3 per cent, glucose 50 per cent, isotonic sodium sulphate and sodium iodide 15 per cent. Distilled water, in the absence of an all-glass still, is obtained from a copper apparatus plated internally with tin but possessing no spray tap, and it is quite probable, therefore, that the distillate contains pyrogens. The removal of these substances, which may also exist in the medicament, is accomplished by adsorption on moderately finely powdered activated charcoal, one gramme being added to each litre of solution. It was found that ordinary filter paper would not remove the finer particles of charcoal and, in the absence of a sintered glass filter and vacuum pump, some other efficient method of filtration had to be improvised.

A water pump, capable of producing an appreciable negative pressure, can be made quite simply from a one ounce bottle, a two-holed rubber bung and a few odd pieces of rubber and glass tubing. The bottom of a one ounce vial was removed by means of an emery wheel and the rubber bung of an unserviceable blood-taking set inserted. Glass tubes were fitted into the bung, one, a short one, the exhausting tube and a longer one, bent so that the tip, which was slightly pointed, was directly opposite the neck of the bottle and about $\frac{1}{2}$ inch from it.

Into the neck of the bottle was fitted a perforated cork through which was passed a glass tube with a slight constriction near the end. The protruding portion of the cork and the neck of the bottle were encased with a small piece of rubber tubing (Diagram 1). The tube (*a*) was attached to the water supply by a short length of pressure tubing and a mercury manometer connected to the tube (*c*). By slight manipulation of the tubes (*a*) and (*b*), relative to one another, a maximum negative pressure of $19\frac{1}{2}$ inches of mercury was obtained.

THE PREPARATION OF THE SOLUTION.

A Winchester quart bottle (*a*), (see Diagram 2) containing freshly distilled water, the medicament and suspended activated charcoal, and fitted with

a two-holed rubber bung, through which pass a long air inlet tube and a short delivery tube, to which is attached a short length of rubber tubing and pinchcock, is inverted and supported from the edge of a convenient shelf by means of a bracket (*c*). The filter (*d*) consists of a blood transfusion drip counter lined with a single thickness of calico to remove the larger particles of charcoal, whilst the second filter (*e*) contains a pad of tightly packed pulped filter paper, prevented from blocking the outlet by a small pad of calico. The solution flowing into the receiver (*b*) is crystal clear and

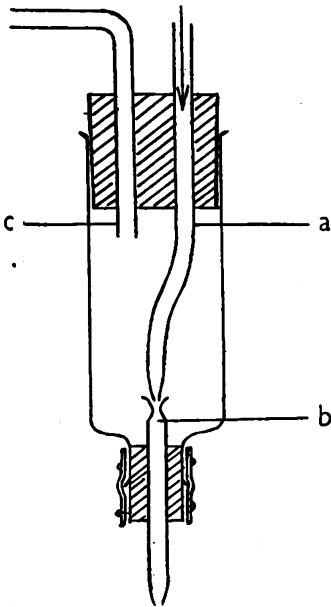


DIAGRAM 1.

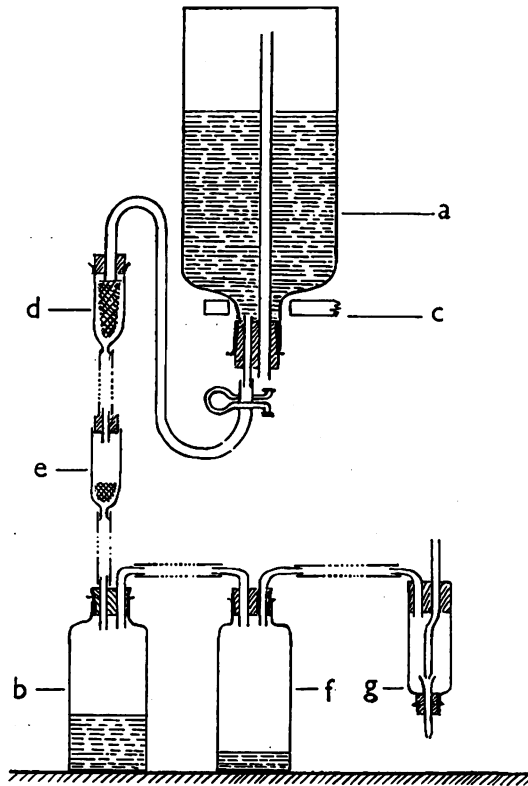


DIAGRAM 2.

free from all visible particles. The receiver is exhausted of air by means of the pump (*g*) previously described, a pint bottle (*f*) being placed in the circuit between the pump and the receiver to prevent any small quantities of water, which may flow back from the former, from contaminating the filtrate.

Normal saline, glucose saline, glucose 50 per cent and isotonic sodium sulphate are filtered direct into their final containers, pint plasma bottles being used for the purpose. The bottles are sealed by means of grey rubber bungs and metal caps (as used for plasma) and finally administered by means

of the overseas type blood-giving set. Blood-taking sets are also set up, 100 c.c. of 3 per cent sodium citrate solution being filtered into each pint bottle. The latter solution is also packed in 2 ounce bottles for rinsing through French's needles prior to the taking of blood.

Pyrogen free distilled water is filtered into a half-gallon bottle and immediately sterilized and, as required, is packed in 2 ounce bottles which are closed with a plug of non-absorbent cotton-wool and re-sterilized. Suitable bottles are those in which solutions of procaine hydrochloride are issued to the Army Medical Services. Solution of sodium iodide, not being in such regular demand, is packed in glass-stoppered bottles.

In all the above cases, sterilization is effected by heating in an autoclave, the periods of heating laid down in the Pharmacopœia being adhered to. In the absence of a dust-free cupboard or glass case, all stock sterile preparations are stored on shelves protected from the dusty atmosphere by a weighted calico curtain, the edges of the shelves being padded with gamgee tissue.

A SUBSTITUTE PETRI DISH LID.

BY STAFF-SERJEANT G. DAVIDSON,
Royal Army Medical Corps.

THE war-time shortage of glassware and the difficulties in maintaining supplies has made it necessary to conserve broken articles of laboratory equipment made of glass. Petri dishes are particularly vulnerable, especially the lids.

A method has been devised whereby lids may be made for either the top or the bottom halves of Petri dishes making two plates from one.

The method is as follows: A stiff paste of flour and a boiling 1:1,000 solution of perchloride of mercury is prepared and allowed to cool. A flat smooth board about 2 feet square is smeared with the paste and the half of the Petri dish placed inverted on it. A sheet of newspaper about 9 inches square is placed over the plate and moulded to its shape with the fingers. The paste on the board will ensure that the shape is retained. The paper shape is well brushed with the paste, another piece of paper is placed over it and moulded and squeezed into shape with the fingers. It is necessary to use some little force in order to squeeze out excess of paste between the sheets and to smooth out all wrinkles but care must be taken not to tear the paper. This process is repeated until four sheets of paper have been used. More sheets may be used but four have proved ample for the purpose. The final sheet is also brushed with the paste and well rubbed and pressed with the fingers. The paper shape and half Petri dish are now carefully lifted from the board, the half plate removed and the paper shape placed in the sun or hot air oven to dry. When it is quite dry the free edges are cut away with the scissors and the rim trimmed down to 10 mm.

One advantage of these lids is that when plates are poured they may be used very shortly after they have set as the paper absorbs the condensation water. Another is that by using them the stock of Petri dishes may be doubled as lids may be made for each half of a single plate.

If the lids are soaked in liquid paraffin before they are sterilized and providing the fit is rather tight plates may be stored for several days without any appreciable drying.

These lids have been in constant use in two laboratories and have proved quite satisfactory.

My thanks are due to Major R. J. V. Pulvertaft, R.A.M.C., for his invaluable suggestions and help.

Reviews.

MEMORIES OF AN ARMY SURGEON. By Colonel N. J. C. Rutherford, *D.S.O.*, M.B. London: Stanley Paul & Co., Ltd. 1939. Pp. 256. Price 12s. 6d.

There is not a dull page in this delightful book, which will be enjoyed by doctor and layman alike, whether they have served in the Army or not.

Colonel Rutherford confesses to what he calls a bad habit, namely that of trying to sum up the characters of persons whom he meets.

Readers of his book will be glad he has this habit; he makes his characters live before us as we read. His perfect Matron of the Red Cross Convalescent Hospital and his amazing little Greek confidential clerk are gems.

If he pokes fun at some of the senior officers he met a quarter of a century ago it is all so good natured that none could take offence where none is meant.

DISEASES OF THE NERVOUS SYSTEM. 2nd Edition. By F. M. R. Walshe, M.D.Lond., F.R.C.P. Edinburgh: E. & S. Livingstone. 1941. Pp. xvi + 325. Price 12s. 6d.

This is a textbook adapted to the need of students and practitioners. Little mention is therefore made of the more complicated methods of examination of such cases as electro-encephalogram and ventriculogram.

The book is planned in two sections, the first being given over to the principles of diagnosis in neurological cases and the second to a description of the more common nervous diseases.

That a second edition has been found necessary within a year is good evidence that this book has proved its value. Certain alterations and additions have been made in this new edition which improve the volume without adding materially to its bulk.

MEDICINE VERSUS INVASION. By G. B. Shirlaw, L.R.C.P., and Clifford Troke. London: Secker and Warburg, Ltd. 1941. Pp. xv + 208. Price 7s. 6d.

This little book gives the authors' personal views and theories as to how the medical arrangements of the Home Guard, Civil Defence and R.A.M.C. can be adapted and co-ordinated to meet the contingency of invasion.

Methods of attack to be used by the enemy are envisaged and suggestions made regarding the medical arrangements to meet such attacks.

The authors have found it difficult to avoid certain dogmatism throughout in an effort to keep the book as small as possible. There are therefore statements which would not be accepted by anyone responsible for the medical arrangements for invasion in this country.

Certain inaccurate statements are made regarding the R.A.M.C. which show a lack of knowledge of the functions of the Army Medical Service in war.

The book is, in spite of these criticisms, well worth reading and has many excellent suggestions. It draws attention to the necessity for perfect liaison by medical authorities with intelligence to ensure that the former are constantly informed regarding the state of Lines of Communication.

It provides much food for thought and discussion, and should be of interest to all medical officers and especially to those in Field Medical Units.

J. T. R.

SYNOPSIS OF HYGIENE (Jameson and Parkinson). 7th Edition. By Lieutenant-Colonel G. S. Parkinson, D.S.O., M.R.C.S., L.R.C.P., D.P.H. London: J. & A. Churchill, Ltd. 1942. Pp. viii + 712. Price 25s.

The 7th edition of this popular reference book has been produced under the difficulties of war time, but the author and publishers are none the less to be congratulated.

The book is up to date and as usual a mine of information, its usefulness being greatly increased by the numbers of references given in the text.

The section on Water-Supplies, revised by Lieutenant-Colonel E. F. W. Mackenzie, R.A.M.C.(R.), Director of Water Examination of the Metropolitan Water Board, embodies the latest views on water examination and a short description of the metal filters in use in the Services.

The section on disposal of waste matters includes a description of bored-hole latrines and of the ferrous sulphate and lime treatment of sullage water in camps.

The author has included a short statement of the more important war time public health measures though the effects of the war on public health are necessarily left for future editions.

We consider that every Hygiene Specialist should possess a copy of this book which, of course, is also invaluable for those desirous of obtaining a D.P.H.

H. A. S.

ON GUARD AGAINST VENEREAL DISEASE. By E. A. Wilson. London: W. P. S., Ltd. 1941. Pp. 19. Price 1s. 3d.

The title of this little pamphlet is apt and may be considered a suitable motto for the soldier. Much of the advice given is on sound lines, particularly the warning against the effects of alcohol and the recommendation "if you can't be good be careful." The descriptions of the chief venereal diseases are adequate but do not indicate that the author has much experience of them. The best part of the pamphlet is that on prevention but too much stress is laid on extra-genital and non-venereal infection; this may lead to phobias which often prove difficult to counter.

A discussion on the vexed question of compulsory notification and treatment should be outside the scope of a publication such as this and would have been better omitted. The reference to theology (p. 5) is hardly to the point and is certainly in the worst possible taste.

Numerous inaccuracies obtrude themselves and a good deal of pruning is necessary before this little book can be whole-heartedly recommended.

T. E. O.

Correspondence.

DARK ADAPTATION FOR A.A. "SPOTTERS"

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—In Captain Brian Steadman's article in the R.A.M.C. Journal for January on "An Investigation of Night Vision among Personnel of an A.A. Unit," the following sentence occurs: "No steps are taken to dark-adapt the eyes of 'spotters' before they 'take post' from lighted Units." No doubt this article was received several months previously but it should be noted that a War Office letter dated December 16th, 1941, has been circulated to all Commands at home and overseas calling attention to the necessity of taking adequate measures to ensure dark adaptation. With the letter is a copy of the report on the measures indicated, drawn up by the Military Personnel Research Committee of the Medical Research Council.

War Office,

S.W.1.

February 24, 1942.

Yours, &c.,

H. L. TIDY (Colonel),

Consulting Physician to the Army at Home.

G. STREET & Co., LTD., write to us as follows:—

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

We regret that owing to an oversight in printing the name Parke, Davis & Co. was omitted from their advertisement featuring their well-known product "Metatone" from page (i) of the February issue.

Notice.

**THE ROYAL SANITARY INSTITUTE AND THE R.S.I. AND S.I.E.
JOINT BOARD**

90 BUCKINGHAM PALACE ROAD, LONDON, S.W.1

**DATES AND CENTRES OF EXAMINATIONS IN THE
BRITISH ISLES, 1942-43**

The examinations which will be held at each centre are shown by the following letters:

- K Sanitary Inspectors qualifying for appointments in England and Wales. R.S.I. and S.I.E. Joint Board.
 L Health Visitors. Being the examination approved by the Minister of Health.
 M School Hygiene, including Elementary Physiology.
 N Sanitary Science as applied to Buildings and Public Works.
 O General Hygiene and Sanitation, Qualifying for Associateship.
 P Inspectors of Meat and Other Foods.
 Q Food Hygiene, Qualifying for Associateship.
 R Tropical Hygiene for Sanitary Inspectors.
 S Smoke Inspectors.
 T Sanitary Inspectors for appointments outside England and Wales.
 U Qualifying for Membership in the advanced Knowledge of a Sanitary Inspector's Duties.
 V Nursery Nurses. (At the Nursery Training Colleges only.)
 W Advanced Child Study (Psychology and Nutrition). (Suspended for duration of War.)

												1942
CARDIFF ..	..	K	L	—	—	—	—	—	—	—	—	.. March 19-21
LEEDS ..	..	—	L	—	—	—	—	—	S	—	—	.. March 26-28
COLLEGES ..	..	—	—	—	—	—	—	—	—	—	V	.. March 27
BIRMINGHAM ..	..	—	L	—	—	—	—	—	—	—	—	.. April 9-11
NEWCASTLE ..	..	K	L	—	—	—	—	—	—	—	—	.. April 16-18
LONDON ..	..	K	L	—	N	O	—	—	S	—	U	.. April 23-25
LONDON ..	..	—	—	—	—	—	P	Q	—	—	—	.. May 15-16
LEEDS ..	..	—	—	—	—	—	P	Q	—	—	—	.. May 29-30
LIVERPOOL ..	..	K	L	—	N	O	—	—	—	—	—	.. June 11-13
MANCHESTER ..	..	K	L	—	—	—	—	—	—	—	—	.. July 9-11
COLLEGES ..	..	—	—	—	—	—	—	—	—	—	V	.. July 10
LONDON ..	..	K	L	M	N	O	—	—	R	—	T	.. July 16-18
COLLEGES ..	..	—	—	—	—	—	—	—	—	—	V	.. October 9
LONDON ..	..	K	—	—	—	—	—	—	—	—	—	.. October 15-17
												1943
LONDON ..	..	K	L	—	—	—	—	—	—	—	—	.. January 7-9
LONDON ..	..	—	—	—	—	—	P	Q	—	—	—	.. January 15-16
COLLEGES ..	..	—	—	—	—	—	—	—	—	—	V	.. January 29

IMPORTANT NOTICE

Other examinations in 1943 will be announced at a later date, probably in January, 1943.

Entry forms should be sent as early as possible. Any entry may be withdrawn for any reason before the last day for receiving it, or later for unavoidable causes (e.g. illness, military duties) without loss of fee.

The last date for the receipt of entry forms is given in the regulations for each examination and on each entry form. This regulation will be strictly enforced and entries arriving after the closing date will in no circumstances be accepted. Entries should be dispatched at least a week before the closing date so that if corrections are needed on them or they are accidentally delayed the form will still arrive in time.

The last days for receipt of entry forms are as follows:

R.S.I. & S.I.E. Joint Board Sanitary Inspectors—21 days before the first day of the examination, i.e. Wednesday.

Health Visitors—21 days before the first day of the examination, i.e. Wednesday.

Sanitary Inspectors for appointments outside England and Wales—21 days before the first day of the examination, i.e. Wednesday.

Other Examinations—21 days before the first day of the examination, i.e. Thursday.

Authors are alone responsible for the statements
made and the opinions expressed in their papers.

Journal of the Royal Army Medical Corps.

Original Communications.

THE ARMY CONVALESCENT DEPOT IN THIS WAR UP TO DATE.

BY LIEUTENANT-COLONEL E. L. SANDILAND, T.D.

Royal Army Medical Corps.

THERE may be members of the Corps who are not familiar with the detailed activities of a Convalescent Depot and who might welcome information on what happens to their patients when they leave their hands.

This short survey of the constitution and activities of one Depot may therefore be of interest and the suggestion that there are certain phases of the work where some modification of the organization and method of procedure might perhaps lead to greater efficiency is put forward with diffidence.

GENERAL REMARKS.

It might be well to draw attention to the title of these Army Units. They are called Convalescent Depots—not Convalescent Homes.

In his book "Organization, Strategy and Tactics of the Army Medical Services in War" Lieutenant-Colonel T. B. Nicholls says: "Convalescent Depots are intended for the reception of officers and men who require no further active treatment and who, though not yet fit for duty, are likely to become so within a reasonable period. The organization, therefore, is directed with a twofold aim; to hasten convalescence and harden by graduated exercises under medical supervision and to retain its occupants. It also relieves the strain in General Hospitals in time of emergency."

Considerable experience was gained during the last war in the organization and running of such Depots. The establishment then was for 2,000 patients per Depot, though there were one or two with greater capacity, up to 5,000 patients.

In summer the patients can be accommodated in tents and marquees but hutments or existing buildings have to be used in winter.

The men go through a graded training so that they will be fit for duty on discharge. If the patient relapses he is returned to hospital; if it is found that a patient cannot be made fit to return to full duty he may be brought before a Medical Board to decide whether he shall be discharged from the Army or his medical category lowered to ensure that he shall be employed only on duties for which he is capable. By this means, during the last war, large numbers were quickly returned to Army duties, sometimes without returning to England at all.

STAFF.

The Staff laid down to run a Depot consists of a small nucleus of officers and men of the R.A.M.C., one of which commands the Unit, and about four officers and fifty other ranks from Infantry Units. These members from the Infantry are "attached troops," as a Depot is definitely a Medical Unit.

MEDICAL WORK.

The medical work entailed is as follows: (a) The medical examination of men on admission and discharge. (b) The medical classification of men on admission, and the weekly re-classification of such men. This may entail the re-classification of sixty or seventy men every day when the Depot is full. (c) The minor treatment of wounds. (d) The medical treatment of emergency illness in a special detention ward of six to ten beds. (e) The supervision of remedial treatment and cases of massage and the use of special remedial apparatus as devised by Dr. Mennel. (f) The supervision of Physical Training Classes.

GENERAL DUTIES.

Other duties which fall upon the Staff are: (a) The administration of the unit as a whole. (b) The holding of daily parades. (c) The allocation and supervision of fatigues. (d) The education of mental exercise of patients, for which a Warrant Officer and sergeant of the Army Education Corps are attached. (e) The organization of games out of doors and in the Depot. (f) The supply of entertainment for the patients.

The Medical Officers have to bear in mind that the Depot is primarily established to get men back to the fighting line or war training as soon as possible. Though life in a Depot can hardly be described as a *dolce far niente* existence yet in the last war, in comparison to life in the trenches, it was certainly a home of modified rest and safety.

IN THE PRESENT WAR.

In this war up to date the campaign has been of a different character to that of the last war and this has affected Convalescent Depots considerably.

In this country a Depot has been established in each Command to hold 1,000 patients. The short campaign on the Continent did not give time for the Depots established there to function to full capacity, as in the last war, though two or three were started.

A Depot overseas may be supplied with cases from Field Ambulances, Casualty Clearing Stations and Military Hospitals. In England during this war the Depots have received patients from Emergency Medical Service Hospitals as well as from Military Hospitals—and, up to the present, more from the former than the latter.

TYPES OF CASES.

The cases dealt with have been: (a) Men convalescing from sickness. (b) Men convalescing from operations performed to render them fit for military service. (c) Convalescing casualties from the French and Norwegian campaigns. (d) Quite a considerable number of French, Polish, Czech, Dutch and Belgian soldiers evacuated to this country.

Many of the first two groups—those convalescing from sickness or remedial operations—have had less than two months' service in the Army.

A number of cases of fracture have passed through the Eaton Hall Depot and have emphasized the growing importance of the orthopædic surgeon.

MISAPPREHENSION OF THE SOLDIER.

The rather unexpected conditions under which Convalescent Depots at home have functioned in this war, and the frequent use of the term "Convalescent Home" instead of "Convalescent Depot," have led to misapprehension on the part of the present-day soldier as to his future surroundings and existence when he enters a Depot.

Men, in some cases after quite a short period in the Army, have been admitted to an E.M.S. Hospital for some sickness or remedial operation. Here they have had the advantage of a completely civilian atmosphere. They have in many cases been frequently visited by relatives and friends and later sent on leave.

These men were not being trained to make them fit for military duty prior to their return to their units. Men are now sent to Army Convalescent Depots after leaving E.M.S. Hospitals and come under military discipline. Leave is dependent on good progress in physical training and good behaviour.

There has been some correspondence in the medical journals on the subject of Army doctors and civilian doctors. It may be difficult for some civilian doctors to realize completely the physical and psychological environment of a soldier. The soldier's duties are frequently arduous and monotonous and at intervals may be attended by great danger to life and limb. In such a community loyalty to the Service and to one's comrades assumes great importance.

Any unnecessary evasion of duty, though it may remove the individual temporarily from danger or boredom, may entail more work and perhaps danger for his fellows. Successful evasion of duties by a soldier is known immediately by his comrades who will perhaps proceed to emulate his example. The initial increase of attendance at the Sick Parade of a new Medical Officer is well known to most officers of the R.A.M.C.

When there is an element of doubt the Army doctor does not necessarily always pronounce in favour of the patient. This implies no want of sympathy on the part of the medical officer, but only an appreciation of his obligations to the patient's comrades.

The atmosphere in a Convalescent Depot is military with parades and strict military discipline. The wards are similar to barrack bedrooms and biscuits are piled at the foot of the beds with kit every morning with military precision. Patients are not allowed to remain in bedrooms after they have been cleared in the morning.

ROUTINE.

The life in a Depot is as follows :

The morning after arrival at the Depot the patient appears before the Medical Officer at 9 a.m., and at the same time and on the same day in each subsequent week. The man is classified according to his medical condition for certain fatigues and for a stage of physical training. Each man is given an identification card with his name and classification for fatigues and P.T. written thereon. This is renewed weekly.

Fatigues are carried out from 9 to 10.30 a.m. The permanent Staff for a Depot is a very small one and the help of patients has therefore to be utilized. If the unit is under canvas the fatigues are not so numerous or arduous. In a hutted camp the huts will usually hold about thirty men in each hut and are easily kept clean. Sanitary fatigues are necessary for both canvas and hutted camps.

Should a large country mansion, however, be granted for the establishment of a Depot the situation is somewhat different and the work entailed in cleaning and upkeep is much increased. Such a building may contain over a hundred bedrooms with an average capacity of five men per room. Many corridors, passages and staircases afford communication in such a building and all have to be kept clean. Large Dining Halls, Libraries and Ballrooms may have to be kept clean and in good condition. The arrangements for Passive Air Defence must be complete and this requires considerable organization and supervision in such a building.

There may be extensive parklands which offer walks to patients and give ample room for football, hockey and cricket grounds. These pitches have to be kept in order by patients and staff.

The gardens round the house may be spacious and ornamental and these, in the absence of civilian staff, have to be kept in order and the lawns mowed. Here again is more work for patients and orderlies.

Patients are kept busy with such occupations until a break at 10.30 a.m., when each is supplied with half a pint of milk.

There is also a dry canteen, run by the N.A.A.F.I., which is open after parades.

PHYSICAL TRAINING.

The patients parade again at 11.15 a.m. in their different categories under instructors of the Army Physical Training Corps of which there are five.

The present-day Army Physical Training endeavours to inculcate rhythm, balance and mental alertness as well as to exercise the muscles. It can also help to correct certain postural deformities. The syllabus of training is well devised to attain this object and includes the use of wooden staffs, medicine-balls of various weights and elaborate children's games.

It is interesting to note that co-ordination of movement and sense of rhythm is very deficient in some of the men who pass through a Depot. In some cases mass parades of 100 to 200 men may be established to do rhythmical exercises to music produced by a gramophone, with pickup, amplifier and loud-speaker. There is danger, however, in such mass parades, of losing the individual attention to certain men which can be obtained with smaller classes.

The patients marked down for special remedial exercises and not fit for the three grades of general physical training parade under male masseurs of whom there are six. These men give special remedial exercises in small classes and a certain time using special apparatus, devised by Dr. Mennel, which includes wall-bars, the stationary bicycle with adjustable resistance, the rowing-machine and the steersman's wheel. Patients are also given massage and passive movements on the couch.

On two days a week a route-march replaces the Physical Training parade. The lame and those in leg plasters are paraded under a Warrant Officer of the Army Education Corps and given a lecture on map-reading and kindred subjects.

Dinner is at 12.30 p.m., when a generous and varied diet is provided including plenty of fresh vegetables.

GAMES.

Organized games under the A.P.T. Instructors take place from 2 to 3.30 p.m. These include cricket in summer, football, hockey and baseball. Those on the early grades of physical training are not allowed to play games.

There are voluntary games from 3.30 to 4.30 p.m.

INTELLECTUAL AMUSEMENT AND ENTERTAINMENT.

A Warrant Officer and sergeant of the Army Education Corps are attached to the Staff. It is the duty of these men to give talks and lectures to the patients on topical subjects between 5 and 7 p.m. They also endeavour to establish classes for mathematics or languages. The rapid change over of population in a Depot renders a continuity of syllabus impossible and the instructors are limited to isolated talks on different subjects.

These members of the A.E.C. also arrange indoor amusements for the patients between 8 and 10 p.m. such as whist drives and darts and domino competitions. There are usually two or more billiard tables in a Depot.

Through the E.N.S.A. organizations concerts and cinema shows are also provided.

The present establishment of a Depot does not allow nine other ranks, as formerly, to form a band or concert party.

RESULTS OF TREATMENT.

Now what of the results obtained with the material sent during this war up to the present time? The proportion of patients suffering from war wounds has so far been small. The following tables, which do not include foreign soldiers, refer to cases which have passed through the Eaton Hall Depot.

Table I shows a rough analysis of 1460 cases who passed through the Eaton Hall Convalescent Depot between January 15, 1940, and September 30, 1940.

TABLE I.
NATURE OF CASES TREATED.

		No. of cases	Percentage
Lungs :	Bronchitis	130	8.9
	Broncho-pneumonia, pneumonia, pleurisy	157	10.7
Abdomen :	Hernias	121	8.2
	Appendix	60	4.1
	Other abdominal diseases	40	2.7
	Rheumatism, sciatica, etc.	77	5.2
	Throat diseases	62	4.2
	Debility	25	1.7
	Injuries, etc., to bones and joints	136	9.3
	Fractures	135	9.2
	Cardiac conditions	20	1.3
	Wounds	132	9.0
	Neuroses	48	3.2
	Miscellaneous	317	21.6
		1460	
	Discharged to unit	1268	87
	Discharged to hospital	191	13
	Died	1	

Cases involving the lungs have amounted to 19 per cent and have mostly suffered from bronchitis and bronchopneumonia. Cases of active pulmonary tuberculosis have been rare as suspicious lung cases have been well investigated clinically, bacteriologically and radiographically before admission.

There is a chance of a case labelled "debility" developing signs of active pulmonary tuberculosis when going through graduated training at a Depot, and this should be discovered at the weekly re-classification parade should the weekly record of weight arouse suspicion.

There has been a rather high percentage—8 per cent—of cases of operation for hernia. The occurrence of hernia may be due to the extra physical strain undergone during training to become a soldier and it suggests a rather poor abdominal musculature among the civilian population. 9 per cent of cases were fractures.

There are a certain number of cases labelled "neurosis." This is a difficult subject and there has been discussion upon it in the medical journals.

Specialist psychiatrists are appointed to give advice in these cases to the relief, I feel sure, of many medical officers.

Cases with gastric conditions present considerable difficulty. A Depot is a non-dieted hospital and can only obtain certain variants from the normal diet of a healthy soldier through Allowance Regulations. Provision of a special diet to convalescent cases would be very difficult and would almost certainly lead to discontent among other patients and unjustified demands from them. Eaton Hall Depot has been spared an influx of such cases because hospitals were warned of their unsuitability before the Depot began to admit patients.

Of these 1,460 cases:

1,268 were discharged to their units fit for duty or modified duty. This represents 87 per cent.

191 were transferred to hospitals for further treatment and in some cases for Medical Boards, a percentage of 13.

1 patient died of cerebral hæmorrhage.

Table II shows the length of service of these 1,460 cases. 70·5 per cent had under one year's service, 23·9 per cent had from one to ten year's service, only 6 per cent had over ten years' service. As the war broke out in September 1939, the above figures are what might be expected but it is surprising how many men have spent much of their Army career up to the present in hospitals.

TABLE II.
LENGTH OF SERVICE OF PATIENTS.

						No. of cases	Percentage
Less than 1 month	...	...	...	...	...	30	2·0
1 month and less than 2	2	...	...	...	...	75	5·1
2 "	"	3	...	...	...	53	3·6
3 "	"	4	...	...	...	68	4·6
4 "	"	5	...	...	...	55	3·7
5 "	"	6	...	...	...	78	5·3
6 "	"	7	...	...	...	113	7·7
7 "	"	8	...	...	...	139	9·5
8 "	"	9	...	...	...	161	11·2
9 "	"	10	...	...	...	124	8·4
10 "	"	11	...	...	...	89	6·0
11 "	"	12	...	...	...	45	3·0
Total up to 1 year's service						1030	70·5
1 year to 2 years	...	...	...	...	...	144	9·8
2 "	4 "	...	...	...	...	85	5·8
4 "	6 "	...	...	...	...	43	2·9
6 "	8 "	...	...	...	...	35	2·3
8 "	10 "	...	...	...	...	33	2·2
Total 1 to 10 years' service						340	23·2
Over 10 years' service						90	6·1
Total						1460	

Table III shows a more detailed analysis of the cases of fracture among the first 625 cases which passed through Eaton Hall Depot.

TABLE III.
ANALYSIS OF THE FIRST SEVENTY-SEVEN CASES OF FRACTURE PASSING THROUGH
EATON HALL CONVALESCENT DEPOT.
(12·3% of the total first 625 cases).

Seat of fracture	No. of cases	To unit	For further treatment
Below the knee	31	9	22
Involving ankle joint	10	2	8
Bones of foot	17	3	14
Below elbow	6	2	4
Above elbow	1	1	-
Patella	2	1	1
Hand	3	1	2
Ribs	3	3	-
Skull	2	2	-
Clavicle	2	2	-
	<hr/> 77	<hr/> 26	<hr/> 51

Many come with plasters on their limbs and a metal stirrup or foot-piece. They are given physical exercises for those parts of the body not confined in plaster. They return at intervals to hospital to be seen by an orthopædic surgeon and when they return to the Depot free of the plaster they are given massage and special exercises.

Thirty-one out of seventy-seven cases had fractures of the leg below the knee.

Below is a detailed analysis of the first 625 cases which passed through the Depot and was devised to discover:

- (a) The average time (in weeks) a patient was in hospital before admission to the Depot.
- (b) The average time, in weeks, before admission that an operation was performed, if any. This point is important when classifying the physical training of cases of hernia or appendix.
- (c) Whether a patient gained weight on the Depot diet. The patients have usually been well fed and rested before coming to the Depot.
- (d) The percentage which were:
 - Returned to unit.
 - Returned to unit for light duties or re-classified at the Depot.
 - Returned to hospital for further treatment or Medical Boarding.
 - 58 per cent had one to four weeks in hospital before admission.
 - 70 per cent of those operated upon had the operation two to four weeks before admission.
 - 59 per cent gained weight.
 - 25 per cent showed no change in weight.
 - 66 per cent returned to their unit fit.
 - 16 per cent returned to modified duties.
 - 15 per cent were sent to hospital.

38 per cent were aged 20-25.

20 per cent were aged 30-40. These latter, and 12 per cent of older men, came chiefly from A.M.P.C. and H.D. Units—many had seen service in the last war.

43 per cent of the 625 cases were kept at the Depot from two to four weeks.

26 per cent were kept from four to six weeks.

FUTURE TYPES OF CASES.

Should an expeditionary force function in the future we shall expect to get rather different types of cases through the Depots. There will almost certainly be a higher percentage of men suffering from war wounds causing considerable disability and perhaps a greater number with war neuroses. The mentality and the outlook of patients are bound to be affected after they have experienced active service in the field.

FURTHER PROBLEMS.

It may be suggested that there is room for a section for Early Convalescents in a Depot where patients can have further treatment before they attain a stage of recovery sufficient to submit them to graduated retraining to fit them for return to their units. Such a section might deal with:

- (a) Gastric cases—mentioned above.
- (b) Fracture cases in plaster.
- (c) Fracture cases for a period immediately after the removal of the plaster.
- (d) Wounded cases evacuated to a Depot after a short period in hospital owing to pressure on the accommodation of the hospital.
- (e) Diversional occupations to stimulate mobility of a limb before the introduction of general retraining.
- (f) Certain cases where there is temporary weakness of the cardiac muscle after some streptococcal infection.

Such an arrangement would entail the division of a Depot into two sections.

- A. For cases in early stages of convalescence as mentioned above.
- B. For more advanced cases to be gradually retrained to fit them to return to their units.

Section A would approximate to the usual conception of a Convalescent Home and Section B would function as the present Convalescent Depot. The Establishment of the Depot would need to be modified to deal with two such sections.

It is open to question whether it would be wise to have a section for more active treatment in close proximity to a Training Section. Patients undergoing treatment might not be anxious to be promoted to the Training Section which would entail harder work and indicate an early return to their units. A specialist in Physical Medicine is now attached to each Command Headquarters to give advice on the early and late retraining of disabled soldiers.

REHABILITATION.

If a soldier be so disabled as to render him unfit for retention in the Army he may yet improve sufficiently to make him valuable to the State. The question of rehabilitation of such men into industry will arise in the future and though this may be of no immediate interest to the Army authorities it is yet a liability of the community as a whole.

Something should be done for those who are so severely damaged that they are unfit for service in the Army. A scheme for rehabilitation would need to envisage:

- (1) Diversional occupations to regain the maximum utility of all the patient's limbs.
- (2) Vocational training to qualify the patient for absorption into industry.
- (3) The absorption of such patients into (a) the general industries of the country or into (b) special industrial undertakings established for such patients and, if necessary, subsidized to counteract any increase in cost of production of articles.

Diversional occupations have already been mentioned as a useful adjunct in the early stages of rehabilitation. The second stage of vocational training will be influenced by the type of industrial activity laid down as the ultimate goal for the patient.

There are two main classes of skilled or semi-skilled workers in industry: the skilled craftsman and the machine-worker.

It takes some years to make a skilled craftsman. Healthy craftsmen do not always welcome a newcomer in their midst who has not been through the normal lengthy course of training and who, by reason of some disability, is not their equal in production. The employer also finds that such men may raise the cost of production. The disabled soldier is not always willing to undergo a long course of training in a new trade before he can earn full wages. Experience gained after the last war disclosed the fact that it was difficult to find jobs for such men when they had completed their rather abbreviated course of training.

It does not take so long to make a machine-worker or machine-minder and there are usually more vacancies for such men in modern industry. The establishment of a special industrial undertaking to train partially-disabled men as machine-minders and afterwards to employ them at reasonable wages would be worthy of consideration.

Such a plant containing much machinery would entail a heavy initial outlay but it would not require such a heavy annual subsidy afterwards to counteract high cost of production as an organization endeavouring to train and employ partly disabled "craftsmen."

There is much more to be said on the details of organizing and working of such a scheme for rehabilitation than can be included in a short article. It is well to remember, however, that the liability for the welfare of these disabled men remains, and any method of reducing, and perhaps in time completely discharging, such a liability is worthy of further study.

AN IMPROVISED ARTIFICIAL PNEUMOTHORAX APPARATUS.

BY MAJOR R. STUPPELL,

Royal Army Medical Corps.

WHEN dealing with penetrating wounds of the chest, the introduction of air into, or the withdrawal of air from the pleural space may be of great therapeutic value, and this procedure is rendered infinitely more easy and accurate if an artificial pneumothorax apparatus is available.

Such an apparatus, however, is not part of the standard equipment of emergency hospitals situated in the more remote regions of the world and it becomes necessary to devise one from the materials available in the medical store.

Fortunately, almost all the parts necessary for the construction of an artificial pneumothorax apparatus are to be found in the standard Army pattern blood transfusion apparatus which may be temporarily dismantled and subsequently re-assembled without deleterious effect to its original purpose.

On page 164 is a photograph of the completed apparatus. It is designed on the Lillingston and Pearson pattern, and consists essentially of two bottles connected together in such a manner that water may be displaced from one to the other at will.

By this means it is possible to drive a known volume of air out of the second bottle, through a rubber tube and suitable needle into the pleural space. Or, alternatively, air may be withdrawn from the pleural space into the bottle.

A water manometer is included in the system so that pressure changes may be observed.

The first essential in the construction of an artificial pneumothorax apparatus is the provision of air-tight connexions and, for this reason, it is necessary to have rubber stoppers for the bottles. Such stoppers, already bored with two holes and provided with glass tubes, are fitted to the blood transfusion bottles and hence this problem is solved immediately.

In the apparatus in the photograph, the longer of the glass tubes in each bottle was replaced by a new one which had been bent to a right angle to prevent any possibility of kinking of the rubber connexion. The long tube should reach to the bottom of the bottle; the short tube extends not more than half an inch within the neck.

The blood transfusion bottles are provided with a wire handle, which is attached to the base of the bottle by means of a metal band. This latter is unclipped and the wire handle disengaged from it and turned inside out so that the hook at either end points outward instead of inward. The handle is then attached to the *neck* of the bottle with a piece of string.

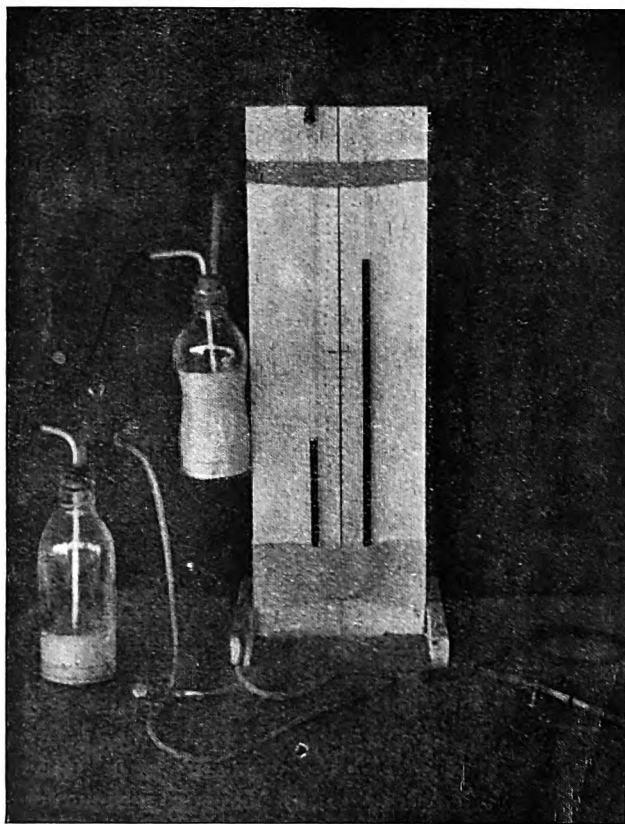
This wire handle now serves to support the bottle on the hook on the manometer stand and saves the operator the trouble of holding it while the apparatus is in operation.

A strip of one inch adhesive strapping is stuck longitudinally on to bottle

number two, the bottle is calibrated by means of a measuring glass and graduated on the strapping at intervals of 50 c.c.

A four-way connexion is next prepared. This can easily be done by joining together with a short length of rubber tubing two glass Y connexions—part of a Carrel Dakin's apparatus.

The manometer is made by bending into the shape of a U a piece of glass tubing approximately 80 cm. in length, so that each limb of the U is about 40 cm. long. But if this operation presents difficulties an equally satisfactory



The completed apparatus.

manometer can be made by joining two straight glass tubes with a short length of rubber tubing.

The manometer is supported on a piece of board of the appropriate size and shape, held upright by two struts as a base, all of which can be obtained, as was done in the apparatus in the photograph, from the side of a packing case.

A hook or nail is inserted into the side of the manometer stand at such a height as will allow fluid to flow from one bottle to another without causing the

manometer to overflow from the pressure produced when one of the bottles is elevated on to the hook.

The manometer is secured to the stand by means of strapping and is graduated in centimetres by means of ink marks on the board.

To one of the limbs of the manometer is attached a piece of rubber tubing which is brought down behind the board and secured to the anterior extremity of one of the struts at the base. If a short length of glass tubing is inserted at this point the remaining parts of the apparatus can be separated from the manometer for sterilization.

Several lengths of rubber tubing are necessary all of which should be of the same calibre as that of the glass manometer.

Finally, four spring clips are needed to open or close the rubber connexions as may be necessary when the apparatus is in operation. One is attached to the rubber tube between the two bottles; a second between bottle number two and the four-way connexion; a third closes off the rubber tube leading to the needle and a fourth that leading to the atmosphere.

A short length of glass tubing containing a small piece of sterile cotton-wool to act as an air filter may be inserted near each outlet of the apparatus.

One of the bottles is filled with a weak solution of dettol, or other antiseptic, and the two bottles are connected together by joining with a piece of rubber tubing each of the longer glass tubes (*vide fig.*).

If now a little air is blown into the full bottle, a siphon action is started and fluid will flow from one bottle to another until the level is equal in both.

The manometer is half filled—that is, to the zero mark, with a watery solution of red ink which does not stain the glass.

The apparatus may now be assembled by joining to the four-way connexion the manometer, bottle number two, the intra-pleural needle with its rubber tubing and the extra outlet to the atmosphere.

The air-tightness of the connexions should be tested by closing the spring clips at each outlet of the apparatus and opening the remaining two. When one of the bottles is elevated on to the hook on the manometer stand the fluid will rise in one of the limbs of the manometer and should remain stationary when the clip between the two bottles is closed.

An ordinary serum needle does quite well for introducing the air into the chest since in these surgical cases the lung is collapsed and is not likely to be injured by the sharp pointed needle.

CHRONIC AND RECURRENT RESPIRATORY INFECTION.

BY MAJOR IAN MACPHERSON, M.D., M.R.C.P.,

AND

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CHRONIC and recurrent respiratory infection, including what is usually called bronchitis, is a potent cause of illness and incapacity in the Army and in civilian life. It is responsible each year, largely in the winter months, for much absence from duty and from work. With a view to obtaining a clearer conception of this important condition we investigated a series of cases admitted to a military general hospital during the period November, 1940, to March, 1941.

The cases admitted to hospital were mainly of two types: Those admitted because of severe degrees of illness, often with recent acute infections, and those sent in for investigation because of their persistent attendance at sick parades in their own units. There was necessarily some degree of selection in the cases investigated and the incidence of the different types of disease in the group of cases studied bears no statistical relation to their general distribution in the Army. Forty cases in all were examined; the length of the history varied from three months to twenty-two years, the average being eight and a half years. The age incidence of the group was as follows: 20 to 29 years, 14; 30 to 39 years, 18; over 40 years, 8. The length of Army service varied from twenty years to a few months, the average being two years and nine months; in 22 out of 40 it was less than one year. From the above figures it will be seen that the largest number of cases occurred in the 30 to 39 years group and that more than half had served in the Army for less than one year.

All gave similar histories; the essential features were recurrent attacks of "bronchitis" with cough and sputum or persistent cough with exacerbations. Many had suffered from pneumonia, some on more than one occasion, and many had had recurrent colds which tended to affect the chest. A number were sent up as suspected cases of pulmonary tuberculosis.

A careful clinical history was taken and a thorough examination was carried out and the chest was X-rayed in all cases; in all but five the sinuses were also X-rayed. Bronchography was performed in a certain number and many had complete nose and throat examination. In selected cases the sputum was examined for tubercle bacilli.

DIAGNOSIS.

The cases were considered in the following groups and the table shows their relative incidence:—

Recurrent tracheobronchitis	..	20
Chronic bronchitis	..	13 (with asthma, 4; with emphysema, 6.)
Asthma	..	1
Bronchiectasis	..	5
Pulmonary tuberculosis	..	1

Recurrent Tracheobronchitis.

The line of demarcation between this group and that of chronic bronchitis is not clear cut but the diagnosis of tracheobronchitis has been applied to the less severe type of case in which cough and sputum alone were the main symptoms. The usual history was of colds which were followed by cough and sputum persisting for weeks, months or even years. There was no gross interference with breathing and no wheeziness, but pain or tightness across the front of the chest was present in some especially during acute exacerbations. Clinical examination revealed few abnormal physical signs in the chest. The outstanding feature in this group is the recurrent cold acting as a starting point of each attack.

Chronic Bronchitis.

In contrast to the group considered above the cases of chronic bronchitis had more or less continuous cough and sputum with wheeziness and breathlessness. Breathlessness is a difficult symptom to assess and it is important to distinguish it from that occurring in effort syndrome. In effort syndrome breathlessness is particularly associated with minor exertion and is accompanied by a tachycardia whereas in chronic bronchitis the relationship to exercise is less definite ; moreover in effort syndrome other signs and symptoms such as palpitation, sweating, fainting, tremors and nervousness are frequently observed. Exacerbations of the bronchitis occurred with colds but the condition rarely improved between such acute phases. As a whole in these cases the symptoms were more continuous and less dependent on season and recurrent colds than in those of tracheobronchitis and, excluding cases of asthma, the average age in the chronic bronchitis group was higher being 35 years in contrast to 30.

Physical signs found in this group consisted of rhonchi and râles usually present in both sides of the chest.

Pathologically it is felt that the two groups fit in with the conception of Engel and Newns (1941) of tracheobronchitis affecting the trachea and larger bronchi and bronchitis affecting the smaller tubes. They point out that the trachea and large bronchi are the favourite sites of catarrh (as might be expected from their position and abundant glands) and that so-called bronchitis is generally tracheobronchitis.

The importance of distinguishing between the two groups clinically lies in prognosis. Tracheobronchitis is largely recoverable with adequate treatment whereas in chronic bronchitis even with such treatment the outlook is much less favourable owing to permanent damage to the respiratory tract.

Asthma.

There were five cases of spasmodic asthma in four of which there was an accompanying bronchitis persisting between attacks. One case of apparently pure allergic asthma was admitted with an acute upper respiratory infection and bronchopneumonia.

Emphysema.

Emphysema was present in five cases of chronic bronchitis and in these the chest was barrel-shaped with little expansion and breathlessness was a prominent symptom. Emphysema occurred in older patients the average age being 40 years.

Bronchiectasis.

It was impracticable to carry out bronchography in every case and the investigation was reserved for the more suspicious ones, for example those with previous history of severe chest illness from childhood onwards and those in which physical signs such as persistent basal râles or pulmonary collapse suggested bronchiectasis. Nine such investigations were carried out and in five the presence of bronchiectasis was established. In two of these collapse of a portion of one lobe of a lung was also present. Complete bronchography of both lungs was not carried out but clinical signs indicated that the bronchiectasis was bilateral in three and unilateral in two. Had investigation with lipiodol been routine it is probable that the presence of bronchiectasis would have been demonstrated more often.

From a consideration of these cases it would appear that a well-authenticated history of recurrent pleurisy without effusion or recurrent pneumonia should lead one to suspect bronchiectasis. Clubbing of the fingers was not encountered in any of the cases. Collapse of the lung is well recognized in cases of bronchiectasis and was present in two out of the five cases. The importance of the finding of bronchiectasis in the Army is that such cases are unfit for military service. The following are illustrative case reports :—

Case 1.—Gunner S., aged 30. Six weeks Army service. History of lung and heart trouble at the age of eight years when he was in hospital for two months; attended as an out-patient with chest trouble for six years after this, and complained of cough and sputum since; two or three attacks of bronchitis every winter. Examination showed diminished resonance and air entry with non-consonating râles at the base of the left lung persisting over a period of two or three weeks. Radiograph showed collapse of the left lower lobe and bronchography revealed cylindrical bronchiectasis in the same region.

Case 2.—Driver K., aged 30. Two months Army service. Suffered from congestion of lungs at eight, measles at 12, pleurisy at 22, pneumonia and pleurisy at 24, and pleurisy again at 27 years of age. Cough and sputum present for eight years and off work for a week or two with bronchitis during each of the last three winters. On recruitment examination showed diminished resonance at the base of the left lung and he was recommended for graduated training. On admission to hospital with cough and fairly profuse muco-purulent sputum numerous râles and diminished breath sounds were present over the left lower lobe. Bronchography showed extensive cylindrical and slightly saccular bronchiectasis of the left lower lobe.

These cases illustrate both the long history and recurrent episodes of more severe chest illness which are liable to occur in cases of bronchiectasis.

Pulmonary Tuberculosis.

In many of the cases sent up for investigation pulmonary tuberculosis had been suspected mainly because of a family history of tuberculosis associated with the symptoms of cough and sputum. It is noteworthy that only one case of active pulmonary tuberculosis was detected. One further case had radiographic evidence of a lesion at one apex and a strong family history but no evidence of its being active was found while under observation in hospital and the case was placed in the tracheobronchitis group.

The low incidence of tuberculosis in this series of cases is partly accounted for by the full medical examination on recruitment because cases of pulmonary tuberculosis with cough and sputum are likely to be eliminated at this stage. An analysis of cases of pulmonary tuberculosis seen during the time that these investigations were progressing was carried out for comparison. There were seven cases in all; four presented as cases of tuberculous pleural effusion; two cases of bilateral chronic pulmonary tuberculosis were found in patients suffering from chronic ischio-rectal abscess and in these there were no chest symptoms. The remaining case was a man aged 32 who had had two attacks of pleurisy with effusion in 1938 and was in hospital for some weeks on both occasions; he had been off colour for some months and had recently lost weight; there was slight cough and only occasional sputum; radiography showed bilateral pulmonary tuberculosis.

The one case of pulmonary tuberculosis included in the 40 cases being studied had recurrent attacks of cough and sputum over a period of two or three years but these symptoms were only disclosed on direct questioning and he was sent up with a note from his regimental medical officer which read: "Has no complaints but under observation, runs an evening temperature in the region of 100° F. Thinks he is losing weight. No night sweats."

It will be seen that the clinical picture in these cases is quite different from that of the recurrent and chronic respiratory infections.

ASSOCIATED FACTORS.

Factors likely to play a part in the ætiology and maintenance of chronic and recurrent respiratory infection were studied.

Sinus Infection.

All the forty cases were subjected to a routine radiographic examination of the nasal sinuses and those in which evidence of sinus disease could be demonstrated by this method and those which exhibited a nasal discharge (even when the radiograph of the sinuses showed no pathological change) were referred to the ear, nose and throat department and twenty-six of the cases were found to need this special investigation.

In considering the history the relationship of the nasal symptoms to the onset and recurrence of the chest complaint was carefully noted. Most of the cases gave

a history of frequent and prolonged colds either accompanied or followed by an attack of bronchitis or laryngitis and such patients often noticed a post-nasal discharge. Headache and periodic sinus pain were rarely described and there was a notable absence of symptoms of acute tonsillitis. In a small number of cases the patient had no nasal complaint in spite of clinical and radiographic evidence of chronic sinus disease.

Complete nose and throat survey was carried out including diagnostic lavage of the antra. Opaque oil (usually instilled directly into the antra although in one or two cases the Proetz displacement method was used) was not found to be of great assistance in diagnosis because most of the cases were seen in the acute stage but, in less acute stages, it was of some help in the detection of hyperplasia of the antral mucosa.

In nineteen patients there was infection of the nasal sinuses and these cases were divided into the following clinical groups: Simple acute sinusitis; acute-on-chronic sinusitis; allergic rhinitis with secondary infection.

All cases were observed over several weeks while in hospital and as out-patients, radiographs being taken at frequent intervals. A case with diminishing signs and symptoms and a normal radiograph after previous evidence of opacity of the sinuses is designated simple acute sinusitis. The larger number of cases were acute-on-chronic sinusitis and in these it was found that the acute upper respiratory symptoms subsided with appropriate treatment leaving some nasal catarrh and intermittent nasal obstruction to which the patient paid little or no attention because he considered the chest complaint to be of primary importance. In the majority of these cases chronic antral suppuration was associated with acute infection of the frontal and ethmoid sinuses and the opacity shown on the radiograph in the acutely infected sinuses disappeared with amelioration of the symptoms. Two cases with a history of asthma and hay fever had oedematous pale nasal mucosa on examination and were considered to be cases of allergic rhinitis with secondary infection. Two cases of persistent laryngitis were encountered, both of which had tracheobronchitis and they only responded to treatment after antral lavage.

As we consider the eradication of sinus infection to be an essential part of the treatment of these chest conditions when the sinuses are shown to be at fault, we include a brief résumé of the routine which we follow in such cases:—

Acute Cases.—All these are treated as far as possible on conservative principles with inhalations. A nasal spray of half per cent ephedrine sulphate in normal saline is used in the milder cases and in the more severe 3 per cent ephedrine sulphate is found to be more effective. Surgical interference is confined to antral lavage. Any cases which do not respond to this treatment are sent for convalescence and reviewed on their return when most of them are found to be sufficiently recovered to require no further treatment.

Acute-on-Chronic Cases.—During the acute phase the routine detailed above is followed after which, if there is evidence of severe chronic sinus infection, the choice lies between radical drainage of the affected sinus or boarding out of the Army.

The relationship of sinus infection to chronic and recurrent respiratory chest disease is generally accepted particularly in bronchiectasis. Difference of opinion has been expressed as to whether the sinuses or the chest are the seat of primary infection but we suggest that a diffuse infection is the initial stage with rhinitis, sinusitis, tracheitis, and bronchitis, and that persistence in one or other situation is the aftermath of the imperfectly healed diffuse infection. In many cases the whole infection is confined to the upper respiratory tract and consists of rhinitis, sinusitis, and tracheobronchitis and, after the acute stage has passed, the tracheobronchitis persists. In a high proportion there is also a residual acute sinus infection, often with a chronic basis, which maintains the infection in the trachea and larger bronchi and we found that improvement of the tracheobronchitis in these cases was commensurate with the response of the sinus infection to treatment. An exacerbation of the sinus infection or further acute upper respiratory infection leads to a flare-up in the trachea and bronchi and if these attacks recur the picture of recurrent tracheobronchitis is presented. It is important that in these infections the respiratory tract should be considered as a whole and attention should not be focused on the "bronchitis" alone to the exclusion of the presence of sinus infection the persistence of which may lead to recurrence.

PSYCHOLOGICAL DISORDERS.

In thirteen out of the forty cases we believe that psychological factors were present and were responsible for a large part of the disability and these included effort syndrome, anxiety and hysterical states. In twelve, the psychological upset accompanied tracheobronchitis, in two, chronic bronchitis, and in one, bronchiectasis. As already mentioned many cases, although not acutely ill, were sent for admission to hospital because of their persistent attendance at sick parades rather than for the severity of the chest condition and this presupposes a measure of psychological instability and accounts for their apparent preponderance in this series. Complete psychological investigation was not carried out in all these cases although some were referred to the command specialist in psychological medicine for confirmation and advice as to treatment.

In these thirteen cases with psychological upset the most important finding was an incapacity out of all proportion to the clinical condition of the chest which persisted long after improvement or cure of the respiratory infection. In addition to the chest symptoms the common complaints were giddiness, sweating, anxiety, tremors, nervousness, sleeplessness, palpitation, breathlessness on minor exertion, hysterical aphonia and anæsthesia, while a history of a previous "nervous breakdown" or "neurasthenia" was elicited in some.

The association between effort syndrome and respiratory infection has been noted recently by Wittkower, Rodgers, and Wilson (1941) who, in a review of fifty cases of effort syndrome, found that in fourteen effort syndrome had developed after an acute febrile illness (usually labelled influenza or acute bronchitis) and seven others "had previously suffered from some recurrent condition such as chronic bronchitis." In the majority of our cases no direct relationship could be

established between the chest disease and the psychological disorder although recurrent illness and a lowered standard of general health made it more difficult for these patients to adapt themselves to Army life. Constitutional susceptibility, home worries and fear played a part in these psychological states and in one at least the psychological disorder was bound up with a life of chest illness and overmuch care and protection at home.

The following are illustrative examples of this group :—

Case 3.—Gunner C., aged 22. Eighteen months Army service. Had suffered from chest trouble since childhood ; stated that he always led a sheltered life as a civilian and always had to take care not to catch cold ; had been forbidden to take part in games because of his chest ; his own doctor had often told him that his trouble was partly temperamental ; since being in the Army he had been ill twelve or thirteen times with catarrh and bronchitis. The patient was very thin with a worried and anxious appearance and complained of cough, breathlessness and sleeplessness. Physical examination revealed occasional rhonchi in the chest, a rapid pulse and a gross tremor of the hands and eyelids. With treatment the cough and signs in the chest disappeared but the breathlessness, tachycardia, sleeplessness and tremors persisted. His mother wrote a lengthy letter giving an account of his difficulties since joining the Army, the degree of hardship which military conditions entailed, his inability to obtain his accustomed type of under-clothing and his consequent unhappiness.

In this case the chest condition did not account for his inability to continue military duties and the case is comparable to those of alleged heart disease who, often on medical advice, have lived a very sheltered life and who, on entering the Army, present the symptoms of effort syndrome. This combination of recurrent chest trouble and the psychological upset associated with the emergence from a sheltered life produces a type of individual who is obviously unsuited to life in the Army.

Case 4.—Gunner J., aged 24, 2 years Army service. Had been quite well until one year previous to admission when he had had an attack of bronchitis for which he was in hospital for one month ; had two further periods in hospital subsequent to this for a similar condition ; now complained of cough and sputum and severe breathlessness on exertion which prevented him from walking more than a few yards. Examination showed a rapid pulse and severe tremor of the hands and eyelids. With treatment the sputum disappeared but he still had a loud barking cough and breathlessness. He was sent on sick leave and returned six weeks later having been ill at home for one month. On his return there were no abnormal physical signs in the chest, he still had his barking cough and had also lost his voice. The loss of voice was purely hysterical and was cured in five to ten minutes by mere repetition of the alphabet.

This patient illustrates the usual course of these cases in hospital in which the chest condition improves considerably but the psychogenic symptoms remain stationary or become worse. The danger of sick leave is apparent. He represents the common type of case encountered in this group of respiratory infections and it is difficult to decide whether the subject is a psychopath in any event, who is sub-consciously exaggerating his chest condition as a "way out," or whether the chest condition is the initial upset whose recurrent nature produces a secondary psychopathic outlook.

While it is likely that the combination of psychological disorder and respiratory infection is more common in the Army it undoubtedly occurs in civilian life as well, as is witnessed by the comparatively heavy work that some severe chronic bronchitics carry out while others suffering only minor attacks are almost completely incapacitated.

ANCILLARY CAUSES.

Nearly all the patients were fairly heavy smokers although not more so than the other types of case admitted to hospital. When smoking was stopped the condition improved more rapidly but no direct causative relationship could be established between excessive smoking and respiratory infection.

It is probable that the disease of the heart or arteries plays little part in the type of case studied and no cases were met with in this series.

Previous civilian employment was not found to be of ætiological significance in any of the cases encountered.

SUMMARY AND CONCLUSIONS.

Forty cases of chronic and recurrent respiratory infection admitted to a military hospital are investigated. The cases fall into two main groups which are designated recurrent tracheobronchitis and chronic bronchitis and these two groups overlap to some extent but the division is justified on clinical and pathological grounds. Of the two, recurrent tracheobronchitis forms the larger group and occurs in younger patients.

In five out of forty cases bronchiectasis was present but its true incidence was possibly higher as bronchographic investigation was not carried out in all cases; a history of serious recurrent chest illness such as pneumonia and pleurisy was elicited in the majority of these patients.

Pulmonary tuberculosis in the hospital over the same period presented a different picture from that of chronic and recurrent respiratory infection and only one case was detected in the forty investigated.

Sinus infection was present in nineteen cases and was found to play a large part in the ætiology of these respiratory infections. As the symptoms of cough and sputum in many only disappeared after treatment of the sinus infection it appears that persistence of these symptoms in many cases is due to the persistence of sinus infection.

Psychological disorder was an important factor in thirteen out of forty cases studied and the types encountered were effort syndrome, hysterical and anxiety states. It is suggested that the chronic and recurrent nature of the chest illness makes these patients less adaptable to Army conditions and more liable to psychological upset although abnormal constitution, worry, and fear are important ætiological factors.

In the investigation of these cases a careful clinical history and examination is essential, the chest and sinuses of all cases should be X-rayed and a full nose and throat survey should be carried out. Simple radiography of the chest is not very helpful in diagnosis but it is necessary for the exclusion of pulmonary tuberculosis

and a permanent record of its absence should always be made. Bronchography should be performed in cases where clinical investigation has suggested the possibility of bronchiectasis. Some patients show an incapacity out of proportion to the severity of the chest condition and in these psychological upset should be suspected and investigated.

Cases of chronic bronchitis, emphysema, bronchiectasis and severe recurrent asthma are unsuitable for the Army and should be returned to civilian life where they may do more useful work under easier conditions. The cases of recurrent tracheobronchitis should be treated on the lines suggested and returned to duty but the more resistant may have to be lowered in category and those with further recurrence despite treatment may have to be returned to civilian life at a later date.

ACKNOWLEDGMENT.

Our thanks are due to Colonel F. Whalley, *D.S.O., T.D., K.H.P.*, for permission to carry out this investigation.

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THE COMPLEMENT TITRE IN HUMAN BEINGS AND THE ROLE OF VITAMIN C IN THE CONSTITUTION OF COMPLEMENT.

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COMPLEMENT being an essential factor in the "antibody antigen" reaction, it is a matter of interest, in relation to immunity, to discover whether or not it is a stable and immutable constituent of the serum. The possibility of its varying in individuals relative to their immunity to disease is an attractive theory which, if proved, might form a hard and fast test of the powers of resistance. In this case, the factors regulating complement would then assume importance, as would also the mechanism of complement function.

To this end, during the summer and autumn of 1938, 100 complement titrations of the serum of healthy and diseased individuals were carried out at the Kent County Hospital, Farnborough, and an exhaustive search was made of the literature dealing with complement. The sedimentation rate was also measured in each case to ascertain whether there was a correlation.

METHODS.

The serum complement was measured in terms of its hæmolytic activity against a standard 3 per cent suspension of sensitized sheep's cells, containing 5 minimal hæmolytic doses (5 mhd.).

The complement value (C.V.) was designated as the reciprocal of the titre. Blood was obtained by vein puncture, 5 c.c. being withdrawn and allowed to clot in a sterile sealed tube in the ice-chest. The serum was kept a further twenty-four hours on ice before titration. The 100 cases examined were composed as follows:

Healthy individuals (Nurses)	..	..	43
Pulmonary tuberculosis	..	..	36
Rheumatic conditions	..	..	16
Acute nephritis	..	..	2
Pregnancy	..	..	3

Preparation of Sensitized Red Cell Suspension.

0.2 c.c. hæmolysin (Rabbit v. Sheep) was placed in 39.8 c.c. normal saline (0.9 per cent NaCl); 2.4 c.c. sheep's cell suspension was then placed in 37.6 c.c. normal saline. The two were then mixed, giving 80 c.c. suspension of sensitized red cells. This mixture was allowed to stand in an incubator at 37° C. for half an hour before use.

Dilution of Serum.

A standard teat pipette of volume 0.2 c.c. was constructed. For convenience this volume was designated as 1 mm. Six Wassermann tubes were set up in a rack

for dilution of the patient's serum, and six more were set up immediately behind them for the test proper. The series of dilutions desired was of the order, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$, etc. Normal saline was placed in each tube as shown in the table :

Tube	1	2	3	4	5	6
Saline	6 m.	1 m.	2 m.	3 m.	4 m.	5 m.
Serum	2 m.					

2 mm. of patient's serum was placed in Tube 1 and well mixed, giving the primary dilution of $\frac{1}{4}$. 1 mm. of this dilution was then transferred to each of the other tubes. In the first row of the tubes was thus the series of dilutions— $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$, $\frac{1}{64}$, $\frac{1}{128}$. 1 mm. of each dilution was transferred to the corresponding tube in the second row.

THE TEST PROPER.

To each tube in the series was added 1 mm. of normal saline and 1 mm. of sensitized red cells. The whole rack was incubated in a water bath at 37° C., the tubes being shaken from time to time. If at the end of five minutes no hæmolysis had occurred in the first tube, then dilutions of $\frac{1}{2}$ and $\frac{1}{8}$ were put up. If at the end of five minutes hæmolysis had already occurred in Tube 6, then dilutions of $\frac{1}{32}$ and $\frac{1}{64}$ were put up.

The tubes were then incubated for half an hour and the last tube to hæmolyse was read. The complement value was expressed as the reciprocal of the titre—e.g. should the last tube to hæmolyse be Tube 4, or $\frac{1}{16}$, then the complement value is expressed as 16 units.

The following table expresses the results in terms of minimal hæmolytic doses (mhd.).

<i>Complement Titre</i>	=	<i>1 Mhd. in Serum</i>
0	..	0 c.c.
4	..	0.05 c.c.
8	..	0.025 c.c.
12	..	0.0173 c.c.
16	..	0.0125 c.c.
20	..	0.01 c.c.
24	..	0.0082 c.c.
28	..	0.0071 c.c.
32	..	0.00625 c.c.

RESULTS.

The 100 individuals examined had complement titres varying from 0 to 32 units. The variations were as follows :

<i>Complement Value</i>		<i>No. of Cases</i>
0	..	11
2	..	2
4	..	20
8	..	24
12	..	19
16	..	12
20	..	3
22	..	5
24	..	2
30	..	1
32	..	1

RELATION TO DISEASE AND SEDIMENTATION RATE (CUTLER'S METHOD).

<i>Disease</i>	<i>No. of cases</i>	<i>Variation in C.V.</i>	<i>E.S.R. Var. in</i>
Healthy	43	0-16	4.7-17 mm.
Pulm. tub.	35	0-22	6.5-27.5 mm.
Rheumatism	16	4-22	6 -32 mm.
Acute nephritis	2	0-8	10 -20 mm.
Pregnancy	3	16-32	16 -24 mm.

DISCUSSION.

Considerable variation is shown in the results outlined and no definite relation to disease can be inferred from the bald figures as they stand. Complement is known to play an essential part in the "antibody antigen" reaction and it might be supposed that an optimum titre would be found in the serum of individuals resistant to disease. However, in the series examined, eight completely healthy nurses had no titratable complement at all and, similarly, two cases of quiescent pulmonary tuberculosis and one case of active acute nephritis with œdema also showed no titratable complement in their sera. It is not conceivable that these individuals had indeed no complementary activity in their blood at all but it is more likely that the test is not sufficiently sensitive to measure the very small amount which is necessary for health. Looking through the remaining results, one finds that cases of active disease—in this investigation these happened to be tuberculosis and rheumatism—all had rather a high titre, or rather the variation tended to run higher than in the case of healthy individuals. This might be explained in one of two ways—either there is a compensatory rise in titre during disease or the complementary activity is influenced by various accessory factors. On looking through the literature, it is found that the complement activity is influenced by many factors—so many, indeed, that the simple titration by a hæmolytic system seems fallacious unless these factors are taken into consideration.

Osborne (1931), in his comprehensive monograph on the subject, reviews most of the present knowledge of complement. He states that it is now recognized that complement is a series of components acting in sequence. Four are recognized—mid-piece and end-piece associated with the globulin and albumin fraction respectively. These are thermolabile and it has been shown that the globulin fraction must act first before the albumin fraction can be bound. The third component is heat stable but is destroyed by cobra venom and a 5 per cent suspension of yeast cells. This component is not used up in the process of hæmolysis and it cannot at any stage be bound to the red cells. The fourth component is also heat stable but is destroyed by viper venom and by the vapour of chloroform or ether. Cadmium compounds also destroy this component—an interesting observation, since cadmium is used in the treatment of tuberculosis.

The order of action of these components is—4th component; mid-piece; end-piece; 3rd component.

The protein nature of the complete complement is proved by the following evidence: (1) Complement is associated with proteins in precipitation experiments; (2) heat inactivation is prevented by sugars which are known to prevent denaturation of protein; (3) tryptic digestion inactivates complement. Noguchi

prepared a substitute for complement and obtained hæmolysis of sensitized red cells from solutions containing fatty acids and albumin. Mixtures of sodium oleate and serum albumin and sodium oleate and calcium chloride have also been used as a substitute for complement. Experimental evidence shows that the liver is responsible for the development of the thermolabile fraction and bile salts have been found to inactivate complement.

Ecker and his collaborators (1938) have discovered a relationship to vitamin C in complement activity and have also thrown light on the role of oxidation-reduction processes in the *modus operandi* of complement. In a paper entitled, "Ascorbic Acid and Complement Function," Ecker *et alia* (1938) stated that the complement titre of guinea-pig sera showed variations during the winter months when it fell to low levels. In their opinion animals naturally deficient in complement are extremely susceptible to intercurrent infections. A correlation was found to exist between the concentration of ascorbic acid in the serum and the complement activity, the latter rising *pari passu* with the rise in ascorbic acid concentration.

In vivo, this held true until a definite level of 1 mgm. per cent ascorbic acid concentration was reached. Sera treated *in vitro*, with optimum quantities of ascorbic acid showed a distinct rise in complement activity and an increased stability.

In a second paper (1938) the same authors demonstrated that ether anæsthesia causes a rise in ascorbic acid concentration in the serum. It might be expected that a parallel rise in complement titre might also be observed. In normals, however, this was not so, no change in complement titre being observed after thirty minutes' anæsthesia. In the case of animals fed on a scurvy diet, however, ether anæsthesia produced a slight rise in ascorbic acid concentration and a definite improvement in complement titre. In a third paper, entitled "The Effect of Ascorbic Acid on the Constitution of Complement," Ecker *et alia* (1938) found that ascorbic acid had no reactionary effect on mid-piece or end-piece when the two constituents were separated by treating the serum with N/300 HCl, or CO₂. On the reconstructed complement, however, ascorbic acid produced an increased action. Complement denatured by yeast was improved by the addition of ascorbic acid. It had no effect on complement which has been denatured by ammonia. The same authors have written two further papers (1938) in which they state that complement can be oxidized and reduced reversibly and that it consists of a number of components acting in sequence. They were then led to investigate the action of Szent-Gyorgyi's hexoxidase which has the property of reversibly reducing ascorbic acid. This enzyme is prepared from the florets of the cauliflower and is thermolabile.

Complement activity was inhibited in sera treated with optimum amounts of this enzyme. They concluded that complement activity is dependent upon oxidation-reduction systems which are chemically reversible and that a state of reduction is essential for the complement to function. It is known, of course, that the serum is inactivated by exposure to the air by shaking with oxygen. Substances which interfere with tissue oxidation—e.g. ether and the barbiturate

group of drugs (Mollari, Randall, and Koppanyi, 1937) also cause an alteration in complement activity.

Barbiturates are anti-complementary and also prevent coagulation of blood on heating. Ascorbic acid is a powerful reductant of lining tissues and the routine tests of saturation, as performed to-day, depend upon its power of reduction. It forms a reversible oxidation-reduction system, however, and is protected from oxidation by glutathione. *In vitro* experiments show that ascorbic acid can only be oxidized when glutathione has been used up.

It certainly seems, from this evidence, that there is a correlation between the ascorbic acid concentration and the complement activity but it is not clear whether the effect of ascorbic acid overlaps that of the complement or whether the latter is entirely dependent upon ascorbic acid.

From the vast amount of experimental work performed on the constitution of complement it must appear that the latter is a separate entity, forming an oxidation-reduction system on its own while ascorbic acid has an analogous action and enhances the hæmolytic activity in the ordinary titration experiment.

That is how the varied results obtained in the present investigations are interpreted. The examination of the sedimentation rate provides some support for this. In the literature there are four papers dealing directly with the relation of complement to the sedimentation rate and one which correlates the ascorbic acid concentration with the sedimentation rate.

Ohtsuka, Terao and Sugui (1932); Tomassino (1934); Bruschettini (1934); and Velecogini and Talusso (1934) all find a reciprocal relation between complement activity and the rate of sedimentation—i.e. destruction of complement caused an acceleration of sedimentation rate. Heisse, Martin, Spencer and Schwartz (1937), found that, in the case of tuberculosis patients, increasing the concentration of ascorbic acid caused a lowering of the sedimentation rate. This is an indirect link between complement and sedimentation rate in view of the recent knowledge of the role of ascorbic acid.

The results of the present investigation show that there is a tendency for the sedimentation rate to be in direct proportion to the complement titre. It is not suggested that there is any definite correlation. Genetic studies on guinea-pigs suggest that complement is not a universal blood factor and can be controlled by selective mating in conformity with Mendel's law (Rich, 1923). Hyde (1932) is of the opinion that lack of complement is a character inherited as a simple recessive Mendelian unit. Faber and Black found that female guinea-pigs invariably showed a consistently lower titre than males. They established the fact that pregnancy caused a lowering of titre. Browning (1931) states that the titre in human beings is lowered by pregnancy. The three cases of pregnancy examined show titres of 16, 24, and 32 respectively. This is not consistent with the above—in fact, most investigators claim conflicting results. Rachmilewitz and Silberstein (1937) found a persistent lowering of complement titre accompanied by a rapid sedimentation rate in cases of rheumatic fever. In cases of rheumatoid arthritis they found a high complement titre with a normal sedimentation rate. They claimed to be able to differentiate between the two diseases by the complement titre.

All the cases of rheumatism examined showed a very variable complement titre, 4 to 22 units, with sedimentation rate varying from 6 to 32 mm.

It is thus seen that complement activity is influenced by heredity, by ascorbic acid concentration, pregnancy, the oxidation mechanisms of the tissues and, probably, by diet since the liver produces the protein fraction. An enzyme contained in the tissues of a common article of diet (the cauliflower) can inactivate it as also can chloroform, yeast, cadmium compounds, bile salts, and barbiturates. Most of the cases of tuberculosis examined were receiving either cadmium or gold and it was decided to investigate the action *in vitro* of sanocrysin on complement.

0.02 gm. of the crystalline salt was dissolved in 4 c.c. normal saline; thus, 0.2 c.c. of this solution contained 0.0015 gm. of the salt. 0.2 c.c. was chosen because this happened to be the volume of the standard test pipette. This volume of solution of sanocrysin was added to 0.2 c.c. of a serum of known complementary activity, 0.2 c.c. normal saline and, finally, 0.2 c.c. sensitized red cell suspension was added to all tubes. A control experiment was set up in the next rack; in the control tube, 0.2 c.c. serum, 0.4 c.c. saline, and 0.2 c.c. sensitized red cells suspension were set up. Twenty-four different specimens of sera were examined the tubes being placed in one rack and incubated at 37° C. for thirty minutes. At the end of that time hæmolysis had occurred in all the tubes of the control sera but, in the series containing sanocrysin, no hæmolysis had occurred. Thus, 0.0015 gm. sanocrysin had inactivated the complement activity of 0.2 c.c. serum.

Complement is therefore an extremely unstable element with so many factors operating in its function that its titre must have little significance. The most striking thing arising from this investigation is that cases of tuberculosis and rheumatism had a high titre especially where the disease was active. In quiescent cases values of 0 and 4 and 8 were obtained as in healthy individuals.

These cases had been under gold treatment, the tuberculosis with sanocrysin and the rheumatism with solganal B. oleosum. Advanced cases of tuberculosis, who were frankly dying and were receiving no treatment, had high values as had active cases of rheumatoid arthritis. It is the author's opinion that a high concentration of ascorbic acid in the serum was responsible for the high titre. The relation of this to diet is interesting—the tuberculosis patients all received a liberal rich diet of which oranges were a regular feature. The cases responding well to treatment enjoyed their food and ate well; their complement titre was low. The advanced cases were very ill and did not eat all that was provided for them; their complement titre was high. In the case of the rheumatic patients, they received the ordinary hospital diet, and showed a high titre. The nursing staff all received the same diet, and their titres varied from 0 to 16.

This, then, does not suggest that the complement titre was due to ascorbic acid concentration. Viewed from the simple conception of intake, tissue saturation and renal excretion, it was not. The work of Ecker, *et alia*, on the relationship of ascorbic acid to complement function, however, appears to indicate that ascorbic acid undergoes a reversible oxidation in the tissues being reduced again for excretion by the kidney. The only form in which ascorbic acid is examined

by the clinical investigator is in the reduced state. Glutathione can protect it from oxidation *in vitro* and it is possible that the same enzyme is active in the tissues. The concentration of reduced ascorbic acid may be allowed to rise until a maximum, or threshold, is reached at which point glutathione ceases to act and the acid is oxidized in the tissues. It will be recalled that, in Ecker's experiment on ether narcosis, certain anomalies were observed. Animals fed on a scurvy diet only had any improvement in complement titre and this was accompanied by a slight rise in ascorbic acid concentration. The complement titre also was improved *pari passu* with the ascorbic acid concentration only so far as the point when the latter reached 1 mgm. per cent. There is no experimental evidence to explain this but it might be surmised that, at the concentration mentioned, oxidation of the ascorbic acid had begun and the complement activity could not therefore be further enhanced.

The hypothesis which it is desired to present is as follows :

Ascorbic acid, in a normal individual, attains a maximum concentration in the reduced state after which it commences to be reversibly oxidized. This may be brought about by the presence in the tissues of the enzyme hexoxidase.

Where the oxidation occurs at the "normal" level a low complement titre is observed. Should any abnormality be present in the system, glutathione-ascorbic acid-hexoxidase, then reversible oxidation does not occur and a high complement titre is observed because the high state of reduction in the serum enhances hæmolytic activity. It is likely, in this case, that the ascorbic acid cannot be utilized while it remains in the reduced state. Clinical workers have long emphasized the importance of vitamin C in rheumatism and tuberculosis and have administered it freely to their patients. It is true that the vitamin is responsible for the well-being of the connective tissues generally. Healing in tuberculosis is by fibrosis after the initial infection is overcome. Fibroblastic activity might well be retarded by a lack of vitamin C ; similarly, the lesions of rheumatism appear to stimulate a reticulo-endothelial response and might well be a primary degeneration followed by a secondary proliferation.

If there is indeed a vitamin C deficiency, it is suggested that this is not simply dietetic but is due to the inability of the tissues to utilize the reduced ascorbic acid in the serum on account of a "biochemical lesion" at the site of tissue oxidation.

All the knowledge of the biochemistry of complement function is from *in vitro* experiments and there is a definite risk in applying these facts directly to *in vitro* tissue reactions. There would appear to be a profitable field of research here, particularly with regard to the metabolism of ascorbic acid and its relation to disease.

SUMMARY.

In 100 cases of normal and diseased individuals, the complement titre was found to vary from 0 units to 32 units. Healthy individuals in no case had a complement titre higher than 16 units. Cases of active tuberculosis and rheumatism had a higher titre than quiescent cases under gold treatment. There was

a tendency for the erythrocyte sedimentation rate (ESR) to be in direct proportion to the complement titre.

The literature dealing with the subject is reviewed and prominence given to the work of Ecker and collaborators in discovering the relation of ascorbic acid to complement activity and the role of oxidation reduction systems. An experiment demonstrating the anti-complementary effect of sanocrysin is described.

The variability of the complement titre is discussed, and the factors influencing the titre described. An hypothesis as to the metabolism of vitamin C and its relation to complement is discussed.

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A R.A.M.C. HOSPITAL IN CRETE.

BY LIEUTENANT-COLONEL R. K. DEBENHAM,

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A DELIBERATE attack on an Army General Hospital must be a rare occurrence and suddenly presents unexpected problems in an acute form. It is evident that the enemy do not respect hospitals if the site is of strategic importance to them and a short description of the experience of a 600 bedded General Hospital in Crete may therefore be of value.

It was seven o'clock on the morning of May 20 when the attack on the island and hospital site was launched with intensity and suddenness ; *the tented hospital was bombed repeatedly and raked with machine gun fire from many aeroplanes.* Free movement in the hospital was paralysed and everyone who was in any way ambulatory was soon in a slit trench which affords excellent protection against such attacks and reduces casualties to a minimum. Dug-in tented wards are of considerably less value, but are helpful. The aerial attack lasted for about two hours and was followed by the appearance of many large troop carrying planes from which about 300 parachutists descended on to a piece of ground a few hundred yards from the hospital. Most of the parachutists never reached the ground alive, or were soon accounted for, but a number of them came into the hospital, replaced the Red Cross Flag by a Swastika (this was soon rectified) and impounded all up-patients and personnel who could be found. These were collected together and were marched off down the road out of sight. (In point of fact, they almost all returned twenty-four hours later.) Any movement from the slit trenches was followed by the whizz of a sniper's bullet. This state of affairs lasted for some time until the parachutists had been satisfactorily accounted for by the New Zealanders who re-occupied the area and during the rest of the day all was quiet on the ground though enemy planes paid frequent visits.

It was quite evident that the hospital area as such was a dangerous spot so, when all was quiet and dusk had fallen, all remaining patients (i.e. those who were bad cases and those who had not been discovered by the parachutists) were removed to safety into caves which were fortunately not far distant by the sea shore. From that time onwards the hospital became a " Cave Hospital " and work was carried on there.

Fortunately there were several good caves along the rocky coast ; our faith in the protection afforded by the Red Cross had temporarily disappeared and it was decided to give the enemy no clue to the whereabouts of the new hospital. This made proper work very difficult ; movement by day was hampered by the sudden and frequent appearance of aircraft and all major activities such as

removing necessary equipment, collecting rations and so on had to be carried on under cover of darkness. The blackout also had to be considered.

The cave hospital presented new problems all of a sudden ; the state of the floor needed attention as it had been frequented by goats and other animals. The irregular surface and strange slopes did not help the arrangement of patients though the slopes were useful when Fowler's position was indicated. No beds were available but patients can be made surprisingly comfortable on stretchers or mattresses. Such cooking as was necessary was done on primus stoves in a corner of the cave. There were five "surgical" caves and one "dysentery" cave. Each cave was responsible for its own cooking. Rations were distributed beforehand and a central dump or Quartermaster's Stores was established in a convenient spot under an overhanging ledge of rock.

The severely wounded patients and the new cases requiring operations were collected into the largest and best cave and here an operating table was set up and necessary surgery carried out both for our own people and for wounded German prisoners. The patients were magnificent ; they never grumbled though it was difficult to give them a fair deal. Cramped space, poor light, awkward slopes, and lack of proper hygienic arrangements made work difficult. Water was carried from a well some distance away and had to be carefully conserved. There was fortunately plenty of sea water a few yards away, and the sea was useful for the disposal of excreta. Incidentally a corpse which had been laid outside the cave till burial could be effected at night was fired on by machine gunning from the air.

On May 23 a New Zealand Field Ambulance, falling back with the Division, formed a Main Dressing Station in a building nearby which had previously been used as the Hospital Officers' Mess. They reported that their Red Cross Flag had been completely respected and from that time onwards a large Red Cross was displayed over the caves most of which were conveniently near together and all the work was carried on in an ordinary way, quite openly, irrespective of the presence of enemy aircraft ; the Red Cross was absolutely respected except when one of the trucks belonging to the Field Ambulance and bearing the Red Cross was deliberately attacked by cannon from the air and destroyed.

The Field Ambulance M.D.S. and the Cave Hospital thereafter worked in complete co-operation ; wounded were evacuated and new cases admitted ; at least 500 patients were housed in the caves. It was most unfortunate that, during the first hour of the attack, both the Hospital Medical Store and the Dispensary were completely destroyed by fire so that equipment was short and many important drugs were unobtainable. It is interesting to note that, in spite of the impossibility of giving A.T.S. (it had been destroyed), the subsequent incidence of tetanus was negligible no doubt due to the previous administration of toxoid. The lesson to be learned is that *two medical stores* are safer than one.

The cave hospital was improving day by day as it became more organized and as more equipment was brought in under cover of darkness ; but the enemy

was advancing and was not far away when orders came to move on May 25. In the subsequent trek across the island, during which time a surgical team worked with the Field Ambulance, the need for improvising became even more insistent. Army tin hats are excellent as drinking cups, as wash hand basins, or as bed pans ; if all strapping has been expended a 6-inch nail removed from a wall will make a good improvised extension for a fractured femur if driven through the sole of the boot. When elaborate treatment is impossible it is surprising how well patients get on if they have rest, food and drink and some simple wound treatment.

Editorial.

GEORGE PEARSON, M.D., AND COAL DUST IN THE LUNGS.

NOWADAYS we know a great deal about coal dust in the lungs. We know, for instance, that, having been breathed into the lungs with the air, a great deal of it is kept in the lungs and not breathed out again or used up in the body. It is thus that we explain the gradual blackening of the lungs of human beings, especially town dwellers, and the intense coloration of these organs in coal miners, both phenomena a matter of daily observation to those accustomed to the post-mortem room and the direct observation of bodies after death. We know—but how do we know? We know because George Pearson found out!

"The course of investigation," he says, "led me to experiments and observations which I respectfully submit for the consideration of this (the Royal) Society."

And why did Pearson take up this line of research? "To explore the path of pulmonary tuberculosis."

This report bears the date 1813 and we may assume that the work was done in 1812, just 130 years ago. Is it not an astonishing thing that the conception of this work came to an observer seventy-two years before Robert Koch discovered and described the tubercle bacillus? Pearson must have had in mind a very correct picture of what happens in tuberculosis to think out the probable effect of a blockage in the lung lymphatics on the inception or course of this disease.

He began his experiments on the black glands of the lung. These glands, the tracheo-bronchial and broncho-pulmonary glands as we call them to-day, "are situated at the root of the lungs externally with a cellular membrane near the bifurcated trachea as well as internally on or near the long branches of the bronchi.

"On pressure between the fingers to burst the moist content a black fluid issued which stained the skin, which rendered water black and which did not alter in colour or dissolve even at boiling temperature, either in water or in concentrated muriatic or nitric acids.

"On breaking the structure down and titrating in a glass mortar a thick black liquid was produced, but after repeated affusions and titration I could not deprive these masses of their colour though the water was at last scarcely tinged. Only by dissolution in caustic potash or nitric and muriatic acid could I totally separate the black matter from the animal substance to which it adhered.

"By boiling the black glands in lye of caustic potash their structure was destroyed and a turbid black liquid produced from which in several days deposited a clear liquid.

"The bronchial glands were dissolved at a boiling temperature in liquid muriatic acid, specific gravity 1.170, affording a black liquor which would deposit

and, evaporated to dryness, ended in a black powder. Liquid nitric acid was on the whole better for this purpose."

He notes that, from uncoloured glands, no such black matter was deposited.

"A similar substance could be removed from the blackened areas by similar measures but no black deposit could be removed by water after the first blackness was washed off."

He goes on to identify the nature of the black powder. "By sprinkling a little on fused nitrate of potash, deflagration took place as with charcoal wood or soot. The same took place with melted oxymuriate or chlorite of potash but at a lower temperature; the deflagration with nitrate of potash was produced in a suitable glass vessel to collect the compounded gas which was received into lime water and found to be charcoal gas. The black powder easily ignited upon a plate of platina and was speedily burnt off and left a minute residue of red or whitish powder. The black powder was ignited in a green glass tube closed at one end and kept red hot for ten to fifteen minutes, the end being stopped with a clay lute to prevent admission of air. White vapour was discharged and there remained on cooling a fine black powder which lost from one-seventh to one-quarter of the original weight. On treating the coaly powder by exposing it to fire and with the pneumatic apparatus, the products were always charcoal gas, hydro-carbonate gas, much water with generally a little empyrumatic oil." From the above properties, "I conceive," says Pearson, "I am entitled to declare the black matter obtained from the bronchial glands and from the lungs to be animal charcoal in the uncombined state, i.e. not existing as a constituent ingredient of organized animal solids or fluids."

He thought that it would be reasonable to suppose that the particles of coal should be retained "in the minutest ramifications of the air tubes or even in the air vesicles" and, to support his theory of transfer of coal in the lung compared the black lines and black net-like figures on the surface of the lungs with plates of the lymphatic vessels by Cruikshank, Mascagni and Fyffe, finding them to present an exact resemblance. "I entreated Mr. Wharrie of St. George's Hospital whom I knew to be a skilful anatomist to inject these vessels with quicksilver. In some the injection passed without interruption in the usual manner but in others it was apparently obstructed by meeting with the black lines on the surface."

He could not argue that the charge of tubercle bacilli, when present in the air breathed, would be held up in just the way that Mr. Wharrie demonstrated with his quicksilver—because the discovery of the tubercle bacillus was still to come. He turned, however, to coal dust and to the lung to help him and derived a lesson from his studies which remains alive to-day.

What, then, of coal particles and other dusts and germs that happen to be breathed in with the vital air? They pass along the tracheal and bronchial tubes, a great many of the heavier agglomerations being caught on the vibrissæ of the nose or being dropped on to the surface of the mucous membranes over which the current finds its way, but a large number, perhaps the majority of the very small particles, suspended in the travelling air, arrive at the respiratory bronchioles

and on to the infundibula and the alveoli. There they finally adhere to the alveolar walls and become phagocytosed and carried to the cells between the alveoli and, for the first time, find themselves literally *inside* the lung and subject to no impulse but that of phagocytosis and the gathering lymph flow. It is probably true that there are no real lymph channels before the levels of the respiratory bronchioles but there is a flow of lymph between the cells and it seems that alveolar phagocytes can be carried onwards until the formed lymph channels are reached. Once in the lymph channels the phagocytes with their contained carbon particles or bacteria or both must face the changes and chances of travel, some being held up at the lymphoid collections at the bifurcations of the bronchioles and bronchi, others making their way onwards until the tracheo-bronchial lymph glands are reached. Thus it is that the lungs, or rather certain areas of them where the lymph circulation passes, get their colour when the atmosphere happens to contain coal dust—a practically universal state of things in a place where every house burns coal to some extent—and that the tracheo-bronchial glands stand out as black or blue stained masses at the roots of the lungs.

Nothing is more striking than to find, as one constantly does, collections of carbon particles in the tracheo-bronchial glands of rabbits to which has been given intratracheally a dose of coal dust into the lungs. And this highway of the dust is also the highway of bacterial particles of a resistant and persistent type. It may be that many easily dissolved bacteria are digested within the phagocytes on the journey but this does not apply to the tubercle bacilli. These travel or get held up in just the same way as the dust particles except for one outstanding difference—the *tubercle bacilli may slowly multiply* whereas the dust particles remain as they are! It is necessary to put in the word "may" because even the resistant tubercle bacillus has a hard fight for it in the interstices of the lungs, and a great many die on the journey; but some at least survive and multiply in the majority of cases. It is necessary, therefore, to picture both dust and tubercle bacilli in intimate contact within the lymphatic spaces and glands of most lungs, the tubercle bacilli being perhaps in a state of obsolescence where they have been inhaled in very small numbers and in a condition of rapid increase where they have been inhaled in large numbers. It all depends, then, what has got in besides the coal dust. If silica dust has entered there will be a great deal of reaction and a marked piling up of coal dust as well as silica at the bifurcations of the bronchioles. If a considerable number of tubercle bacilli have entered, then there will be the danger of tuberculosis. But this danger may well be deferred or rendered non-existent by certain circumstances inherent in the proximity of the coal dust to the bacilli. It seems that the more active toxin of the tubercle bacillus, the part of its production which enables it to elaborate harmful processes in the tissues, the auto-tuberculin, as it is called, can be adsorbed on to the carbon dust and thus be rendered harmless for the time being though the bacillus itself may continue to live and multiply. And yet another process may perhaps ensue; the lipid part of the tubercle bacillus becoming united in some way to the carbon so that giant cells are collected in numbers and a great mass of carbon and cells formed which can effectively bar the passage of further coal particles through

the lymphatics. Thus all further charges of coal dust through that part of the lung are held up and form an increasing mass which gradually saps the passage of blood and becomes almost, but not quite, necrotic. Where silica dust, coal dust, and tubercle bacilli all get breathed in together this mass formation is often very marked and reveals itself as a number of black silico-anthracotic areas over the surface of the lungs. Why is it that the silico-anthracotic coal miner generally stands free from tuberculosis until a late age and that he very often breaks down after sixty or seventy and dies rapidly of tuberculosis? Some of us think that the explanation is just that given above. That is why we appreciate so thoroughly the work of George Pearson who examined this question in such a scientific manner with a view to throwing some light on "the path of pulmonary tuberculosis."

Echoes from the Past.

H.R.H. THE DUKE OF CONNAUGHT ; ANOTHER ANGLE.

BY COLONEL F. J. BRACKENRIDGE, C.M.G.,
Late Royal Army Medical Corps (Retired).

THE correct and formal appreciation of the Duke which appeared in our January Journal gives but a small view of his many-sided humanity and his interests in things other than military.



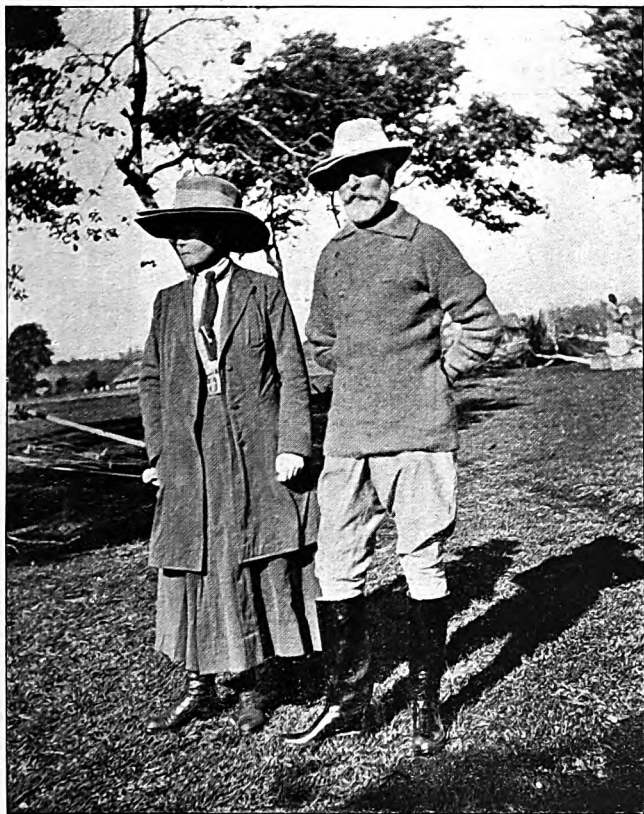
The Duke.

Of these, and they were many, sport was prominent and he missed no opportunity of joining in such amusements as his world-wide duties brought to him. On occasion he even made tours primarily with sport in view. Two of such jour-

neys were his fortnight up the Nile from Khartoum in 1909 and his four months in East Africa in 1910, when he went, mostly on foot, all round Mount Kenya, about 450 miles, on both occasions leaving officialdom behind and allowing himself a complete change to the simple life with ceremony left out.

On both of these trips he took with him the Duchess of Connaught, Princess Patricia and Prince Arthur of Connaught with Miss Pelly as lady-in-waiting and Captain Tommy Bulkeley, Equerry.

Of all this, having been attached as Medical Officer, I can tell with first-hand



The Duke and Duchess in camp dress.

knowledge and could fill a large book with story and incident, sporting and otherwise.

The trips were, of course, well prepared and on rather *de luxe* lines, which however does not imply that the shootings and huntings were so. They were always genuine and often strenuous.

The Nile trip was made on the Sudan Government stern-wheel steamer *Omdurman* which was specially set apart and arranged, she being their largest and newest

boat built for the Upper Nile postal and tourist service. She carried a Greek caterer (Cavadias), a real cow and sundry other comforts additional to those available to smaller parties on a Nile nugger.

The Sudan Chief Game Ranger, "Beastie" Butler as he was called by his friends, joined up somewhere north of Kodok and was promptly adopted at his nickname by the whole party. His wife was with him in their nugger which was tied up always on the leeward side of the ship because of its load of trophies of the chase in various stages of cure or decomposition, the atmosphere of which was much too strong for amateurs!

"Beastie" saw to it that sport was soon forthcoming and a good representative bag was gathered in about six days' shooting, including waterbuck, cob, harte-



Princess Patricia.

beeste, gazelle, oribi, guinea fowl and buffalo. We had some faint hopes of elephant but hardly reached the elephant country and lion too might have been bagged but we did not see any.

So the day came when it was necessary to turn home in order that the Duke should fulfil future engagements.

We were then somewhere south of Taufikia and as, in this country, there was a possibility of getting a "Mrs. Gray" antelope, a trophy only to be had in the Sudan, it was decided, as time permitted, to keep on south for one day more keeping a sharp look out for this species and to stop for such time as it took to clean out flues and boilers and then streak down stream.

Next morning when daylight broke we were all out full steam ahead for Khar-toum, Home and Duty. We stopped about half-way for wood (fuel) and having seen some nice white-eared cob not far back the Duke would have a try and I took him again. It was swampy ground, a series of green plots intersected by deep water channels thickly covered with Nile cabbage, and I expect, though it did not occur to me for a while, reeking with sleepy crocodiles. It proved too much for us and we could not get near the game but we did get soaking wet up to our necks and I also got a wiggling from Tommy Bulkeley when I mentioned "crops."

I don't know whether the Duke thought of them at all, and anything I said to the boys about them would be in Arabic which he did not understand, but a year or so later, in East Africa, talking of our Nile trip he did say, "Did you ever think about 'crops' that day."

Clinical and other Notes.

N. I. PIROGOV—FOUNDER OF MILITARY-FIELD SURGERY.

BY ACADEMICIAN N. N. BURDENKO.

Soviet Medicine, 1941, No. 6, p. 3.

THIS great surgeon was born 130 years ago. He wrote important books on surgery. His claim to greatness rests on his three principles of treating wounds :

- (1) Rest to the wounds—protecting them from further hurt.
- (2) Immobilization of the wounded part and of the whole limb, including neighbouring joints.
- (3) Use of anæsthetics, first rectal ether, then general anæsthesia with chloroform.

He appears to have been the first to use plaster-of-Paris bandages which played a large part in the treatment of the wounded at the siege of Sevastopol. His indications for the use of plaster-of-Paris bandages were : Wounds with much destruction of soft tissues, fractures of diaphyses of long bones, wounds of joints.

It is remarkable that this method was not revived till the Great War and it has since been used in the Spanish Civil War and in the Finnish campaign of 1939/40.

"I shall never forget my first arrival in Sebastopol," he said. "The wounded were lying in carts, two or three in each cart, shivering with cold. Dead animals and carrion were everywhere. Birds of prey were hovering about. And in the camp of martyrs rain fell, men and mattresses were soaked through. Men lay in dirty pools of water. Imagine how it was to lie, three to four men together with amputated limbs."

He then applied all his will to alter all this. He demanded :

- (1) Proper classification of the wounded into five classes from the most seriously injured to the lightest wounded.
- (2) A good administration.
- (3) Surgical skill in war shall not be primitive but doubly keen in the sense of greater flexibility, improvisation and inventiveness. No matter how difficult the military conditions, help should be rendered most effectively and completely.

He writes : "I suggest that in war nothing more could be demanded of the administration and surgical staff than that, firstly, in dressing stations, after the sorting of fractures and joint wounds, these should be well bandaged with plaster-of-Paris, with no pressure on the soft parts, with or without windows, according to circumstances. Secondly, all bleeding should be carefully controlled. Thirdly, the wagons transporting the wounded from the dressing stations to military hospitals should be well spread with hay or straw, the wounded not crowded, and guarded from rain and cold. Fourthly, the transport must be supplied with

medical and police supervision, warm food, water, wine, bandages and medicines. Fifthly, the distance should not be far, and the time not too long, before the transport arrives at its destination."

He set himself to put these ideas into practice. But he had a great number of conflicts with the authorities and the discouraging obduracy of the administration cannot even be imagined. He could not bring about any improvement in the treatment of the wounded, better distribution, or transport. So one can imagine his joy when the Institute of the Sisters of Mercy was founded. This helped him, in a measure, to smooth out the terrible conditions which he found. The first experience of the work of the sisters in conditions of military field surgery was exceptionally favourable, thanks to the choice of the first sisters and the exceptionally talented nurses Kartseva and Bakunina. Other favourable conditions were that the military operations were carried out in the conditions of positional warfare, when it is easy to organize and train cadres of sisters, constantly in touch with the doctors, who worked by their side.

BLACKWATER FEVER.

BY MAJOR C. H. G. PRICE,

Royal Army Medical Corps.

History.—In September, 1940, five French soldiers from French Equatorial Africa were landed as survivors of a British warship that had been bombed and sunk. All suffered from the effects of immersion and exposure with minor traumata in some instances. Four developed symptoms suggestive of malaria.

Case 1.—Corporal P. The blood was examined on September 17, 1940, when the parasites of malignant tertian malaria were found—*P. falciparum*. Appropriate treatment was given and the patient made a clinical recovery.

Case 2.—Private B. A blood count was performed on September 25, when the total red cell count was 2,550,000 per c.mm., and the hæmoglobin was 60 per cent. *P. falciparum* was demonstrated in the blood films. In this case there was some appearance of jaundice but with treatment recovery took place. There were no other symptoms of increased hæmolysis.

Case 3.—Serjeant V. The blood was examined on September 27, when no malaria parasites could be found. This examination was repeated on October 3, when *P. falciparum* was discovered in the blood films. Treatment resulted in clinical recovery.

Case 4.—Serjeant A. On September 20, Serjeant A. (a Eurasian) developed pyrexia with rigors and anuria, and a blood examination carried out on that date showed the presence of *P. falciparum*. On the same day a blood count showed the total red cells to be 2,500,000 per c.mm., and the hæmoglobin to be 70 per cent.

He became rapidly jaundiced, and on September 21, his blood count (red) showed deterioration to 2,050,000 per c.mm. and a blood transfusion was given

to which there was no clinical reaction. On September 23 his total red cell count had dropped still further, to 1,600,000 per c.mm., but no parasites were found in the films. The small quantity of urine passed on that date showed acid hæmatin in large amounts. Treatment had been instituted with alkalies and this resulted in the change of the reaction of the urine to alkaline, with alkaline hæmatin present. The blood urea was estimated on September 23 and found to be 400 mgm. per 100 c.c. There was terminal suppression of urine and death ensued on September 24.

ABSTRACT OF POST-MORTEM EXAMINATION

(BY MAJOR H. E. BONNELL, *Royal Army Medical Corps.*)

External appearance: Patient well developed, shows slight icterus and rigor mortis.

Lungs and Pleuræ: Fibrous adhesions at right base. Solid œdema of both lungs, but no sign of pneumonic consolidation.

Heart: Dilatation of both sides. Heart muscle flabby and shows considerable cloudy swelling. Valves and vessels healthy.

Liver: Shows advanced fatty changes, also slightly bile stained. The gall-bladder is distended with thick biliary mud.

Spleen: Slightly enlarged, Malpighian bodies prominent.

Kidneys: Swollen appearance. Acid hæmatin can be observed in the tubules. The capsule strips easily.

Anatomical diagnosis: Left ventricular failure consequent on blackwater fever with renal failure.

Histological Examination.—A. Liver: This shows patchy fatty degeneration of the liver cells, a large number of which contain granules of yellowish pigment.

B. Spleen: Shows congestion and thickening of the reticulum fibres. There is widespread pigmentation, some of the granular material being extracellular.

C. Kidney. (i) The glomeruli show a considerable cellular increase, and direct measurement of fifty glomeruli shows that the maximum width of the capsular spaces varies between 15 and 55 microns, with an average of 28.5 microns. As the vast majority of the glomeruli show empty capillaries, this dilation must be due to absence of blood in the glomerular vessels. 30 per cent of the capsular spaces measured are less than 30 microns.

(ii) The convoluted and loop tubules show marked cloudy swelling and in some cases nuclear changes and desquamation of epithelial cells. The lumina of the great majority contain amorphous eosinophilic material together with red cell detritus and degenerate epithelial cells. The average outside diameter of 40 descending loop tubules is 34 microns with a range of from 22.5 to 45 microns.

The average outside diameter of a similar number of the ascending loop tubules is 58 microns, with a variation of 37.5 to 70 microns. Judging by the figures given for these tubular measurements in Maximow and Bloom's "Textbook of Histology," 1935, there would appear to be considerable increase in size of the outside diameter of these tubules.

(iii) Collecting tubules and papillary ducts. These are almost entirely filled with aggregations of degenerated red corpuscles and epithelial cells. There are also granules of yellowish-brown material, some of which have been taken up by the remaining epithelial cells (this is also noted to a much smaller degree in the more proximal tubules). The collecting tubules show an average outside diameter of 66 microns, with variation of 55 to 88 microns. The papillary ducts vary in diameter from 65 to 150 microns (outside).

(iv) The intestinal tissue shows mild oedema and cellular infiltration.

COMMENT.

(1) From the history of these cases it would appear that the malarial attack and blackwater fever were possibly occasioned by exertion, fatigue or by exposure to cold due to immersion in the sea. Unfortunately at the time it was not possible to examine the blood for the Donath-Landsteiner phenomenon. There was nothing to suggest an allergic causation.

(2) The histological appearances of the kidney in some respects resemble that described by de Nevasquez following incompatible blood transfusion and also after experimental injection of hæmoglobin into rabbits. The main point of similarity is the emptiness of the glomerular capillaries. The most striking differences are two, namely (i) in this case of blackwater fever there was debris in the great majority of the tubules, and in practically all the collecting and papillary ducts; and (ii) there was evidence of distension of the proximal portion of the nephron. This latter would appear to be secondary to the blockage of ducts and tubules. It is possible that the increase of pressure associated with the distension of the proximal portion of the nephron was partly responsible for the empty state of the glomerular capillaries. The completeness of the blockage of the collecting tubules and papillary ducts coupled with the widening of the capsular spaces would suggest that the mechanical blockage was the factor responsible for the anuria which developed in the course of the illness. During the course of the illness there had been a blood pressure adequate to ensure glomerular filtration but not apparently sufficient renal tissue capable of functioning. The appearance and the measurement of the component portions of the nephron would suggest that the blockage occurs mainly in the collecting tubules and papillary ducts.

SUMMARY.

- (1) A case of blackwater fever is described.
- (2) Measurement of the size of various parts of the nephron showed distension of the proximal portion.
- (3) It would appear that this distension is due to blockage of the collecting tubules and papillary ducts.

REFERENCE.

DE NEVASQUEZ, S. (1940), *Journ. Path. and Bact.*, 51, No. 3, November.

CASES OF JAUNDICE.

BY MAJOR J. W. OSBORNE.

Royal Army Medical Corps.

DURING a period of six months forty-nine cases of catarrhal jaundice were treated in this hospital. No cases were treated in the winter-time.

In the early spring (April) the usual endemic cases began to appear. Two cases were reported in April—one from Lisburn and a Royal Marine from sea.

In May two cases were reported from the same unit with an intervening period of seven days.

No cases were reported in June.

In July the figure rose to three cases—one from Lisburn, one from Gilford and one from Lurgan. These features suggest the ordinary spring and autumn incidence of the disease in an endemic nature.

In August an epidemic of cases, thirty-eight in all, broke out in a unit at Coleraine. It is interesting to note that, apart from these cases, the ordinary endemic nature of the disease is still present as the remaining cases number six only with a distribution which includes widely separated areas—Ballycastle, Newry, Londonderry, Cullybackey and Doagh.

The degree of jaundice was not extreme. The usual features were nausea, malaise and gastro-intestinal disturbances, for periods varying from sixteen days to a week, followed by the onset of jaundice. All cases were jaundiced on admission except one who was admitted as gastro-enteritis. In all, the pyrexia was slight or not marked and subsided after a short period in bed.

As would be expected, the icterus index was proportionate to the degree of jaundice. All except three cases had a normal leucocyte blood picture. These three seemed to be in the early stages of the disease with slight jaundice only. The counts were never higher than 13,400 and all three showed a relative lymphocytosis which in one case was as marked as 40 per cent. Six cases had enlargement of the spleen. No case showed agglutination to Weil's disease.

The van den Bergh reaction was carried out in all cases and the icterus index of the urine. Thirty-eight cases showed a positive diphasic reaction and two a positive indirect. In all the former the icterus index was always greater than 30, in the latter two 10 and 6 respectively. This is the picture of a hæmolytic rather than an obstructive jaundice. Four cases had a negative van den Bergh with icterus indices of 5, 1, 5, and 20. No explanation can be offered for these figures.

A relationship was noticed clinically between the degree of itch and the depth of jaundice. Where the jaundice was marked, itch was nearly always present at some stage. An association was also noticed between the presence of bile salts in the urine and itching of the skin.

Pigment and salts were present together at some stage in all cases. In some, pigment was more predominant than salts, in others the reverse, but both salts and pigment disappeared together.

The stools from thirty cases were examined for abnormal organisms without result.

Several observations were important. Increased leucocytosis with a relative lymphocytosis was noticed early in the disease. Enlargement of the spleen

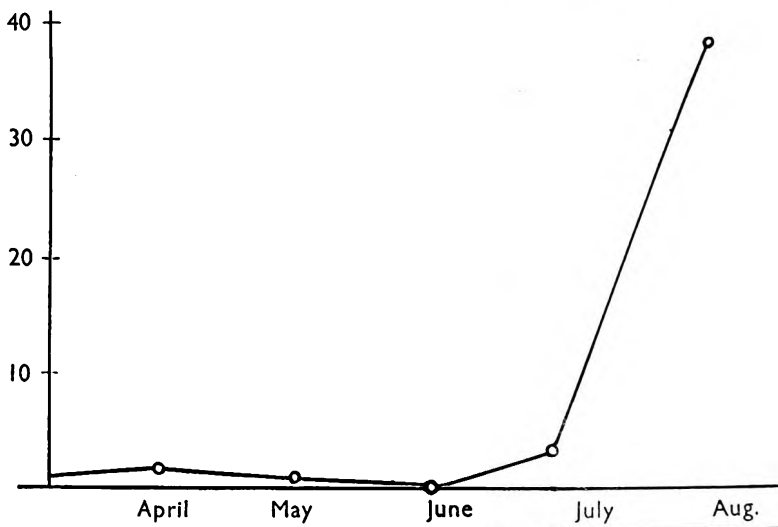
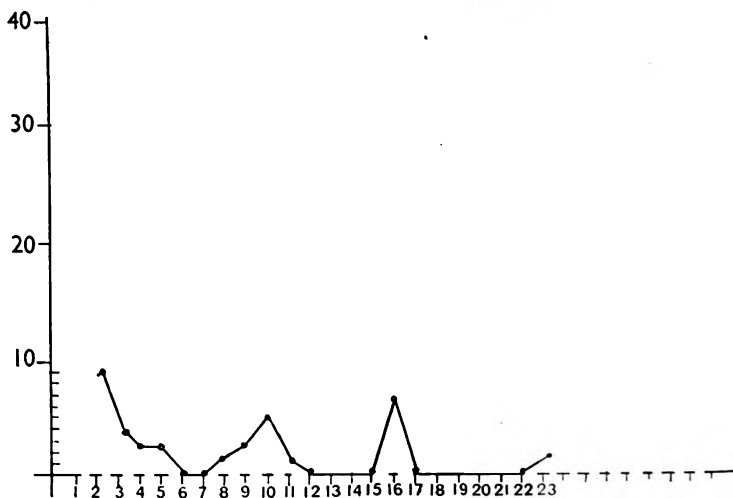


Chart showing monthly incidence.



Daily chart for August.

occurred in 12 per cent. of cases and early in the disease and in cases that subsequently developed a marked degree of jaundice.

An indirect van den Bergh reaction was found only when the jaundice was slight. In one case the icterus index was high—20—when the van den Bergh was indirect positive.

This suggests a pseudo-haemolytic rather than an obstructive onset.

The leucocytosis in the early stage of the disease with a lymphocytic reaction and enlargement of the spleen have the characteristics of a virus infection.

The whole epidemic ran a course of fourteen days from August 2 to August 16, 1941, and then rapidly subsided.

The graphs show the monthly incidence.

THE EFFECT OF VITAMIN A ON DARK ADAPTATION IN SOLDIERS.

BY MAJOR J. R. OWEN,

Royal Army Medical Corps.

- IN view of the accepted importance of nutritional factors in relation to night vision, an investigation was carried out to determine whether or not this faculty could be improved by administering vitamin A concentrates to men subsisting on ordinary Army rations.

In all, twenty-four subjects were tested. All save one had normal vision as determined by Snellen's Test Types. The exception was wearing suitable glasses. Six cases were used as controls. To the remainder, 24,000 international units of vitamin A in one capsule of prepalin (Glaxo) was given daily for fourteen days, the night vision being tested before and after this period. The estimated daily requirement of the vitamin is given as 50 units per kilogramme of body-weight per diem [7].

The photometer used was designed to test both the time taken to accommodate to a standard illumination and the minimum illumination perceptible when accommodation was complete.

All subjects were exposed to a bright light under constant conditions for a similar time before testing, in order to reduce them to a common condition of light adaptation.

The results were as follows :

A. *Subjects Given Supplementary Vitamin A.*

Dark adaptation time reduced in eight cases, increased very slightly in seven cases, unchanged in three.

Perception of minimum intensity of illumination improved in seven cases, very slightly diminished in four cases, unchanged in seven.

B. *Controls.*

Dark adaptation time reduced slightly in three cases, increased slightly in one case, unchanged in two cases.

Perception of minimum intensity of illumination improved slightly in one case, diminished slightly in three cases, unchanged in two cases.

The apparent improvement in night vision which took place in some of the treated cases did not necessarily occur in those whose night vision was initially poor.

The changes in the control group, as well as the anomalous changes in the treated cases where night vision apparently became worse after administration of the vitamin, were slight and may be accounted for by the experimental error inseparable from the procedure as well as by some of the other factors which are known to influence night vision.

Defective dark adaptation is found with advancing age, in states of fatigue and in minor infections [1] and [2], in peptic ulceration [2, 5] hepatic diseases [4], deficiency of riboflavin [6, 7], of vitamin A [1, 2, 8, 9, 10], of vitamin C [2]. It is also apparent that diseases of, or toxic states affecting, the eye itself or those parts of the central nervous system concerned with sight will affect night as well as ordinary vision. In addition to this, impairment may follow deficient absorption of the above vitamins consequent on diarrhoea from whatever cause or digestive disturbances.

In the present series of cases we are concerned with healthy soldiers between the ages of 19 and 35 years. From the fact that so many failed to improve on the relatively large supplement of vitamin given it is reasonable to suppose that this substance is present in adequate amount in the Army dietary and in the case of these men it is noteworthy that pigmented vegetables containing the precursors of vitamin A, especially swedes and carrots, were frequently served at meals.

On the other hand, there is good evidence that night vision, although initially within the range of normal limits in healthy people, can in many cases be improved by increasing the daily intake of vitamin A and a study of a recent literature supports this belief.

Acknowledgements to Squadron Leader M. O. Richardson, R.A.F., and to Glaxo Laboratories, Limited.

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Current Literature.

WILSON, DAGMAR C. Fluorine in the Aetiology of Endemic Goitre.

Lancet. 1941, Feb. 15, 211-12. [18 refs.]

LANCET. 1941, Feb. 15, 216-17. **Endemic Fluorosis.**

This, says the author, is the first of a series of studies on fluorosis. Her findings from examination of school children in England under natural conditions are at variance with the records of experimental work carried out with rats in 1935 by W. May. The latter found that when given to rats fluorine produced hypoplastic changes in the thyroid and, having used fluorine therapy in over 800 patients with toxic goitre, he advocated it for this condition.

The author's investigations have led her to conclude that endemic goitre [associated in places with cretinism—in this respect agreeing with May's experimental results] existed where fluorine was found geologically. In the Punjab she observed a high incidence of mottled enamel—dental fluorosis—among villagers using well-water in goitrous districts; the rocks in the neighbourhood had a fluorine content ranging between 30 and 3,200 parts per million.

In England fluorine-containing rocks are found in Cornwall, Somerset, Buckingham, Derbyshire, Cumberland and Durham, that is corresponding with the present or former distribution of goitre. Dr. Wilson examined rural school children for dental fluorosis in the neighbourhood of known fluorine deposits and, wherever this condition was found, it was stated that goitre still occurred. She next examined in more detail 378 children in a goitrous area of Somerset and 103 others in a non-goitrous area. None of the latter showed any signs of mottled enamel, whereas 30 of the former (7.9 per cent) did, and another 25 were doubtful, as shown in the subjoined table.

It would seem, therefore, that fluorine in the drinking water is one factor in the production of goitre. H. H. S.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 5.

GRIFFITH, A. S., and DALLING, T. Inoculation and Immunity Experiments on Calves with the Vole Strain of Acid-fast Bacillus. Histological Observations by W. PAGEL. *J. Hygiene.* 1940, Dec., v. 40, No. 6, 673-80.

This paper was written before the publication by A. Q. Wells and W. S. Brooke [*Bull. of Hyg.*, 1940, v. 15, 515] of their striking results from immunizing guinea-pigs with the vole bacillus. The present paper also includes some observations made in guinea-pigs; 7 or 9 subcutaneous doses totalling 10 or 12 mgm. of the vole bacillus were given over a period of about

eight weeks, followed by a subcutaneous injection of either 0.001 or 0.01 mgm. of virulent bovine bacilli. In one series the surviving test animals (two having died earlier from other causes) were killed after 94 days (the controls having then all died of tuberculosis) and found to have either localized or early general infection. In the other series the test animals were allowed to die of the disease, which all did in from 109 to 225 days, average 152 days; the corresponding figures for controls were 67 to 111, average 87. It appears, therefore, that the resistance produced in the guinea-pig serves only to delay the progress of the infection.

Experiments were made in 15 calves, 4 being used to study the nature of vole bacillus infection in the calf, and 9, with 2 controls, for immunity experiments. Subcutaneous injection causes a persistent local abscess with infection of the nearest glands; intravenous injection causes small foci containing scanty bacilli in various organs. No progressive infection is produced and the intravenous injection of a single dose of 5 mgm. is recommended for immunization. Tuberculin sensitivity develops rapidly; all the calves so tested reacted, even after as short an interval as 13 days. Both routes and in some animals 2 doses were used in these experiments, and 7.5 mgm. virulent bovine culture were given by the mouth after an interval varying from 21 to 175 days, all the calves being killed about 200 days after this. The controls were found to have extensive glandular tuberculosis; of the 9 immunized animals, 4 had no lesions, and the remainder only few and small foci in mesenteric glands. The injection of gland suspensions into guinea-pigs showed that small numbers of bacilli had survived both in these foci and in a proportion of glands not evidently affected. These results are considered "unexpectedly good and better than those which followed the use of BCG as a vaccine"; further trials are desirable. L. P. GARROD.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 5.

Reviews.

THE INJURED BACK AND ITS TREATMENT. Edited by John D. Ellis, M.D. London: Baillière, Tindall and Cox. 1940. Pp. viii + 377. Price 30s.

This volume is made up of nine exhaustive essays, each by a notable authority, and dealing with a particular aspect of a subject whose importance in this present day of world trauma cannot be over-estimated. In the first of these essays the reader is treated to an account by Sir Arthur Keith of Man's Posture. As might be expected from one who can match his deep knowledge of this subject with so rare a gift of exposition, which makes the complex appear simple, the essay is in the nature of a classic and would alone justify the publication of the book. After so brilliant a beginning, one might be forgiven for expecting a lowering of the standard of knowledge and erudition; but such is far from being the case for

each subsequent essay is the product of expert knowledge and practised authorship, contributed by such men as Earle Conwell, Robert Osgood, Nathan Davis, Loyal Davis and the editor, John Ellis. In such a symposium it is inevitable that opposing views are presented for the subject has still very many controversial aspects and, of course, there is considerable overlap. But neither are serious criticisms of the work. Indeed the presentation of diverse and opposing views in a book of this kind is an advantage for it must stimulate thought and make broader the road toward further advances in knowledge.

No reviewer's cliché can define the exact usefulness of the book and it would probably lie neglected upon the shelf of the busy practitioner or medical student. Its chief value would appear to be to the orthopædic surgeon—in fact to all surgeons in whose practice back injuries are common—and to those physicians who deal, or profess to deal, with symptoms arising from traumatic or infective lesions of the spine. Above all to those who, from ignorance or from inner convictions, profess or in any way support the practice of that pseudo-science labelled Osteopathy do I commend this work for careful study.

The volume is splendidly made, with a very readable type on fine art paper—obviously the manufacture of a country not at war at the time of going to press.

THE LESSON OF LONDON. By Ritchie Calder. London: Secker & Warburg. 1941. Pp. 128. Price 2s. net.

"The Lesson of London" describes the first great Blitzkrieg on London. A vivid picture is drawn of the scenes of destruction, of the magnificent courage of the populace and of the noble work of certain individuals in their attempts to alleviate distress. Suggestions are put forward as to what preparation should have been made both in advance and at the time in the form of deep shelters, provision of food and clothing and evacuation of the homeless.

If the author had contented himself with a description of what he saw and with really constructive criticism nothing but good could have been the outcome; but the exhibition of political bias, the play on class distinction and the excessive employment of the first personal pronoun are more likely to irritate than interest the average reader.

As a piece of political propaganda this little book may be considered a success; as a piece of literature which is likely to appeal to the general public it appears to be quite otherwise. The impression left on the mind is that of a golden opportunity missed.

AIDS TO ANÆSTHESIA. By Major Victor Goldman, I.R.C.P., M.R.C.S., D.A., R.A.M.C. London: Baillière, Tindall & Cox. 1941. Pp. viii + 235. Price 5s.

Major Goldman's book is an addition to the well known "Aids" series. It is hard to see what particular function it is meant to perform or to what part of the medical public it will be useful. The student anxious to acquire the minimal qualifying knowledge in this branch of his studies will rely on his lecture notes,

on his practical teaching, and on the chapter on anæsthetics he will find in his textbook of surgery. Anyone who seeks detailed practical instructions or who wishes to study anæsthetics with special interest will need something more than this brief outline, however well it may, or might, have been drawn.

Major Goldman's outstanding qualities as a practical anæsthetist are well known; the early chapters of his book give an excellent account of the general principles underlying anæsthetic administrations and there is nothing that he says with which there can be any fundamental disagreement. Nevertheless his little book, in spite of its brevity, contains some vaguenesses and inconsistencies. On page 29 we are told that ether has a distinctly toxic effect on the kidneys. On page 146 we are warned against using chloroform or the barbiturates in cases of nephritis but are assured that any other anæsthetic (presumably this includes ether) will produce satisfactory results. Yet surely if ether is toxic to the kidneys, it can hardly be expected to give good results where the kidneys are known to be damaged. Again, the question of spinal anæsthesia for Cæsarean section is discussed on pages 167-8 and we are told that certain deaths which have occurred are suspected of being the result of this combination of operation and anæsthetic and that there is considerable difference of opinion. Then on page 170 we read that "a spinal anæsthetic is often the method of choice." This is hardly encouraging to the occasional anæsthetist who presumably may consult the "Aids."

We note too that although the administration of continuous intravenous anæsthetics is mentioned, the drip-saline method is not discussed: this, we think, should come before any other way of maintaining this form of anæsthesia. Space is given to the question of choice of anæsthetic for operating upon congenital pyloric stenosis, but nothing is said as to what is the best anæsthetic (if any) for routine circumcisions in infants, a much more important point to the senior student or junior practitioner. The table provided in the chapter on spinal anæsthetics gives the doses of stovaine in cubic centimetres, but does not say whether the 5 per cent or the 10 per cent solution is to be used.

We feel that the subject of anæsthetics, in which success depends so much on experience and on careful attention to details, is one which is hardly suitable for brief summarization in the "Aids" manner. Although we wish to congratulate the author on the way he has condensed his matter we can hardly dismiss the points we have mentioned above as trivial oversights.

G. E.

Notice.

THE Director-General desires the attention of officers to be called to the following which may, perhaps, appeal to those about to leave the Service.

Women will be eligible in addition to men.

GENERAL CONDITIONS GOVERNING WHOLE-TIME MEDICAL APPOINTMENTS UNDER THE MINISTRY OF PENSIONS.

Salary :—

£750 per annum on appointment if not less than 31 years of age, with possibilities of subsequent increase up to £875. Travelling expenses and subsistence when on duty, according to regulations.

Nature of appointment :—

Temporary and unestablished. Service not reckonable for superannuation.

Prospects :—

On the termination of the War, it may be necessary to establish a number of Medical Officers. The numbers then established will depend upon the requirements of the Ministry at that time, and selection will depend upon the merits of the particular Medical Officer. Any Medical Officer appointed will, if his service to that date is satisfactory and he is then under 50 years of age, be considered with others, either in the temporary service of the Ministry or not, for establishment. No guarantee of establishment at any time can be given.

Duties :—

The duties, which may embrace any form of medical work, will include :—

- (a) The Medical examination and certification of cases for treatment at Medical Clinics.
- (b) Certification of cases at Appliance Clinics.
- (c) Limb Fitting sessions.
- (d) Medical Boards.
- (e) Domiciliary Visits for the purpose of certification and report where the claimant cannot for medical reasons be called to a Clinic.
- (f) Supervision of a Surgical Clinic.
- (g) Office work necessary in connection with the administration of a Region, and questions of entitlement and assessment.

It is an essential condition of appointment that the officer should undertake to serve anywhere in Great Britain, Northern Ireland or Eire, as required.

Suitable candidates would be required to attend at Headquarters for interview at their own expense. Officers are also required to pay any travelling expenses involved in taking up their first appointments.

This document does not purport to be exhaustive. Medical Officers, in common with all other Civil Servants, are subject to all the rules applying to the Civil Service generally.



Q.E.D.

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A REPORT ON THE A.S.H. FÆCES DESTRUCTOR AND OIL-AND-WATER-FLASH FIRE BURNER.

DESIGNED BY MEMBERS OF THE STAFF OF THE FIELD SANITATION
DEPARTMENT OF THE ARMY SCHOOL OF HYGIENE.

THE basis of success in this destructor is the production of a steady, easily regulated and fierce fire from waste materials by means of a specially designed burner.

Waste sump oil is used as the fuel. This often contains water which can be separated by pouring the whole into a drum provided with a tap at its bottom level. After standing for a while the water collects at the bottom of the drum and can be drained off through the tap. The oil should be strained through a fine sieve to remove solid and suspended impurities which would interfere with its regular and even flow to the burning point. Less than one gallon of oil is used per hour, as a rule, in an average large fire.

In order to produce a really hot flame a ventilated burner is best. Such a burner can be made from the ends of five-gallon oil drums. It consists of two plates separated from each other and held together by bolts and distance pieces 2 inches apart. The upper plate is the smaller and is slightly dished in its centre with a small central cone projecting upwards: the convex outer space is perforated at frequent intervals by driving a 6-inch nail through it from below upwards. The lower plate—slightly larger than the upper—has its central portion convex upwards with a surrounding concave ring. Perforations are made upwards in the same way, through the convex central portion. Each of these plates should have a narrow turned-up edge all round. These two plates, bolted together, form the burner which should stand on a tray somewhat broader and longer than the larger of them.

To produce the "Oil-and-Water-Flash" fire on this burner, the top plate is first heated thoroughly by burning an oily or paraffin-soaked rag or a small fire of dry sticks on the lower plate. When the top plate has become hot and is completely dry, oil with a very small admixture of water is allowed to drip slowly on to it over the still burning small fire below. When "flashing" of the oil takes place the supply of both oil and water may be increased slowly until the whole burner has become thoroughly well



FIG. 1—The A.S.H. Faeces Destructor.

heated up; the proportion of water may then be increased until combustion of the oil is practically complete and only a bluish-white smoke is emitted. If, during ignition, the top plate becomes flooded the flow of oil and water should be stopped and the plate dried and heated up again.

When the burner is used in an enclosed space, as in the destructor, the air for its supply should be admitted through a narrow opening at or above the level of the top of the burner; all other air supply should be cut off if

there is a chimney to serve the fire. In this destructor a small additional air supply above the burning hearth on which the fæces are incinerated has been found useful; it is provided in the lid, which is described later, and comes into operation in relation to the actual firing of the burning mass itself and not as an air supply to the oil burner.

The oil and water supply to this burner is better made through a three-quarter-inch pipe than along a length of open angle-iron. This pipe should be slightly flattened at the end which overhangs the burner plate and overcut so as to provide a projecting underlip. The other end of this pipe can be bored for fixing over a projecting nail set in the fuel-tank stand. The flattened end of this feed-pipe should be so set as to allow a drop of between 6 and 8 inches on to the top plate of the burner. Towards the upper end of the pipe two slots, each about 3 inches long, are cut half-way through and on the upper side so as to allow the admission of the oil at the higher level, and

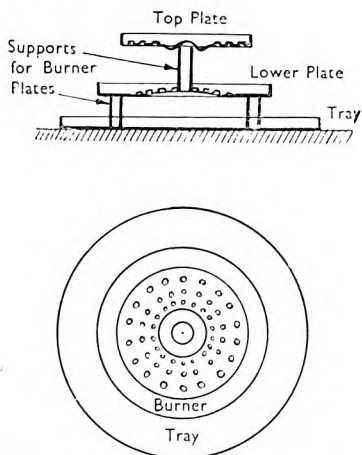


FIG. 2.—Ventilated O-W-F. Fire Burner.

the water below this. Separate containers for the oil and water are best fitted on the two levels in order to permit the supply taps or drippers to come closely over the openings in the pipe; this prevents the streams of liquid being diverted by wind. When taps are not available drip-cans can be made from small jam tins into which, near their bottoms, tin tubes have been soldered. These tubes are made to fit tightly into the bung-holes of five-gallon oil drums. The drip-cans are fitted with round wooden stoppers held in position by rubber bands cut from an old inner motor-car tube. This dripper works on the "chicken-feed" principle, and provides a constant head of liquid in the drip-can so that a constant flow can easily be maintained with the minimum of attention on the part of the operator.

The destructor is built in 9-inch brickwork (or its equivalent), 1 foot 9 inches (seven courses) in height and measuring 4 feet 9 inches by 2 feet

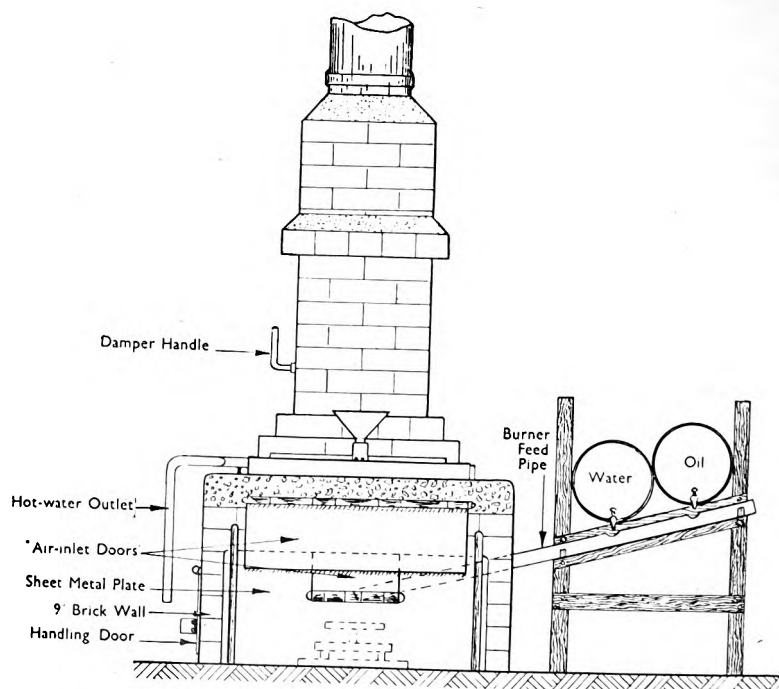


FIG. 3.—Front Elevation, showing arrangement of Fuel Feed.

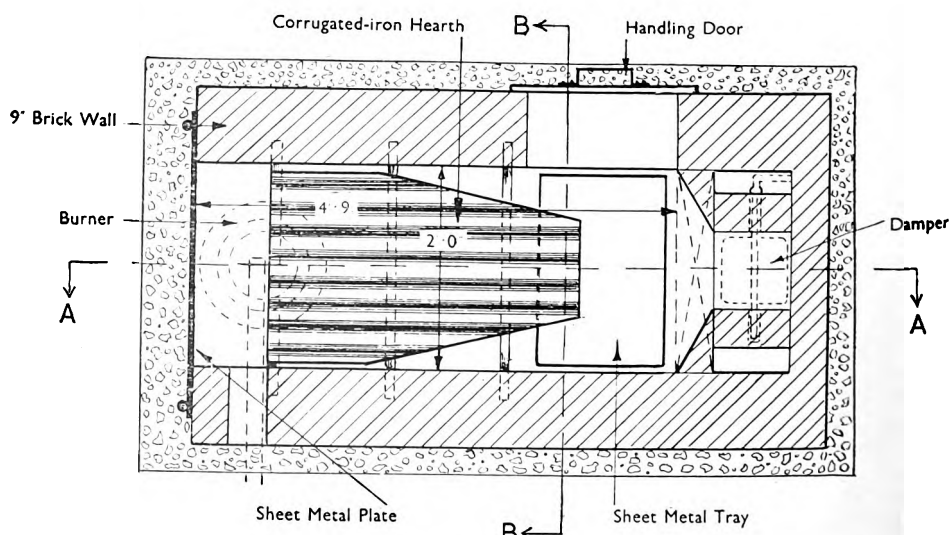


FIG. 4.—Plan.

inside; or 6 feet 6 inches by 3 feet 6 inches outside; the total height, including the top, being 2 feet 1 inch. A baffle arch and a 9 by 9 inch flue are provided; the flue terminates in a chimney, composed of oil drums, to a total height of approximately 12 feet. The floor is of loose bricks bedded directly to earth. The walls may also be lined with loose bricks; these serve to retain heat and thereby assist the combustion process. The front end of the fire-chamber is open full-way and is provided with sheet iron doors designed and arranged to give ready access to the interior; and, in conjunction with a damper in the flue, to afford complete control of draught. The doors are divided transversely. The lower door is held in position by a

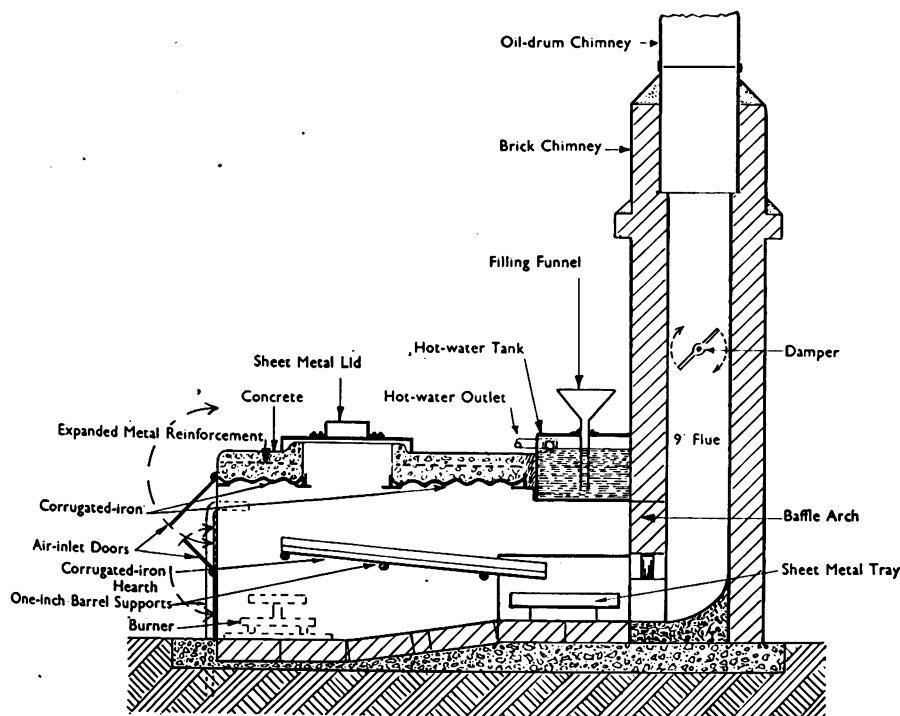


FIG. 5.—Section. (A—A fig. 4.)

couple of iron bars built into the walls and is provided, at its centre, with a smaller door, 12 by 9 inches, hinged to open downwards. The upper door is hinged to, and hangs from, a corrugated iron sheeting which serves also to support the destructor cover. The depth of this door is sufficient to allow it to overhang the lower door when both are closed.

The top of the destructor is formed in lime concrete covered in cement supported on short lengths of corrugated iron placed transversely from wall to wall. It is reinforced with "expanded metal," wire netting, or any similar reinforcement. Owing to the intense heat generated, and the

consequent expansion and contraction, the top will tend to crack considerably; but, if it is properly supported and reinforced, this will be of little significance. An opening, through which excreta can easily be placed in the destructor, is constructed in its top. This is closed by a stout sheet-metal lid, which is provided with a strong handle and arranged to rest on the lower webs of two pieces of "T" iron which serve also to support the corrugated iron base of the cover. The lid is also provided with a small ventilator, the control of which facilitates drying and combustion of the excreta.

The burning hearth consists of a heavy corrugated iron sheet cut loosely to fit the full width of the destructor at the top, or inlet, end and tapering to a width of 1 foot at the other (lower) end; its edges are turned up 3 inches at the sides. This hearth is removable. It is supported on three or four iron

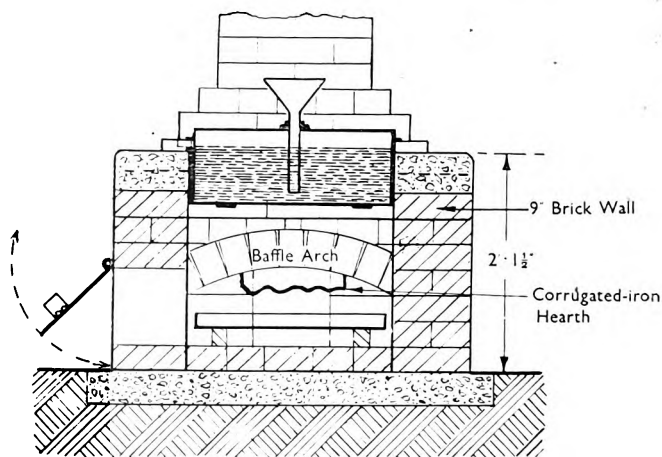


FIG. 6.—Section. (B—B fig. 4.)

bars built into the side walls at levels which give it a slight fall towards the flue, the tapered end being at the lower level and arranged to overhang a sheet iron tray of 3 inches depth. The tray is removable through a sliding door provided in one of the side walls. The hearth and tray are so situated that, by suitable manipulation of the draught control, the whole of the heat generated by the burner is passed over or under them. Solid excreta on the hearth and liquid excreta draining into the tray are thus rapidly dried and are combusted to a residuum small in quantity and of the nature of a white ash.

A hot water tank, with funnel inlet and pipe outlet, is fitted in the top of the destructor where it can utilize spare heat for the provision of hot water for the use of men employed at the destructor.

The schedule of materials for the above-mentioned destructor is given in the Appendix to this report.



FIG. 7.—Improvised Destructor of Petrol Tins.

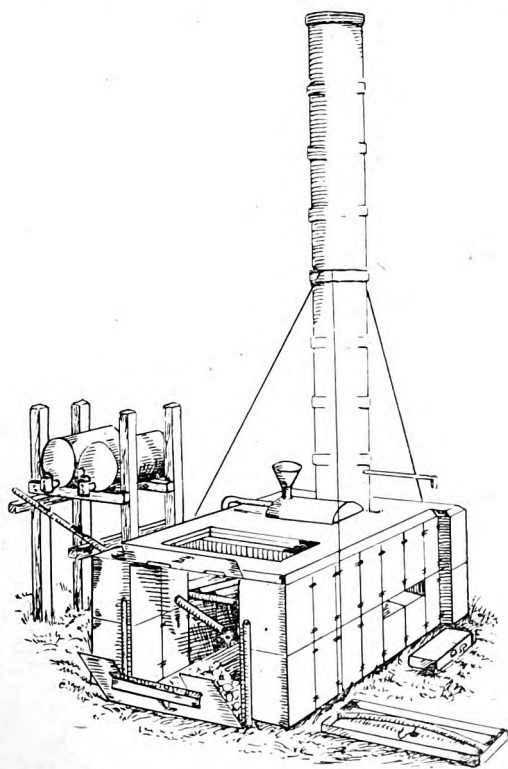


FIG. 8.—Improvised Destructor.

For permanent camps of all kinds the type of construction outlined above is desirable and economical. For camps of a more temporary character, or where brickwork is impracticable, the walls of the destructor may be constructed of petrol or similar tins, wired together and solidly filled with clay.

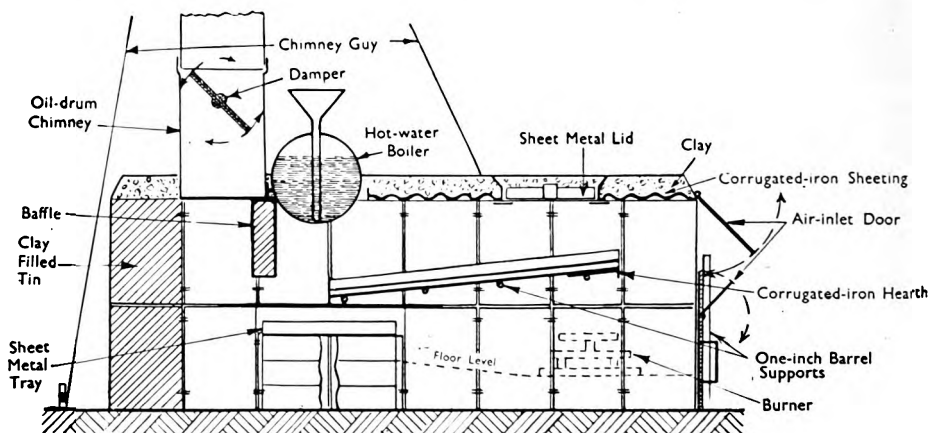


FIG. 9.—Improved Destructor. Type 1. Section.

The necessary height is obtained by two "courses" of tins, the total number required being thirty-eight. Other details are all improvised and similar to the more standard type. In use, the inside portions of the tins are more or less rapidly destroyed but the clay hardens and remains

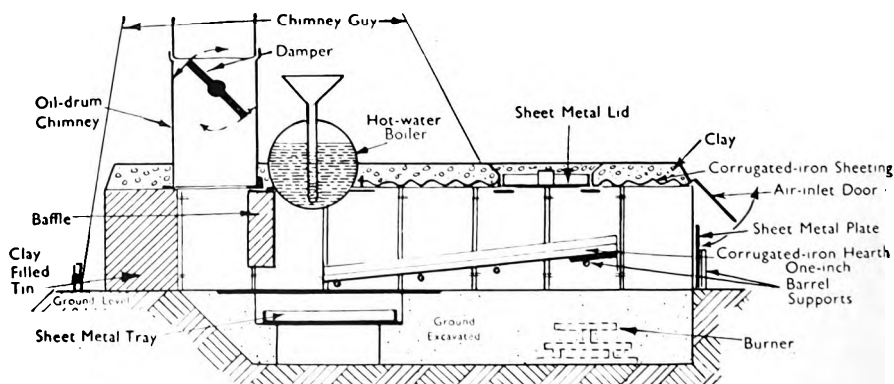


FIG. 10.—Improved Destructor. Type 2. Section.

durable for a considerable time. Clay may also be used in place of concrete for the top cover: it should be supported and reinforced in the same way as for concrete.

A still more rudimentary type may be constructed in which the walls

consist of a single "course" of tins, the burner being sunk into the ground in order to provide the necessary height in the combustion chamber. The sides of the excavation, in this case, must be supported, e.g. by tins filled with clay and laid on their sides: the total number of tins required in this method of construction is twenty-three. The urine-tray is placed on the ground at normal level, a trench being cut to pass under it and to act as a flue.

Owing to their lack of rigidity the destructors of these temporary petrol-tin-built types do not require concrete foundations; they need only be founded on solid earth.

The burner used in the destructor has been designed, after considerable experiment, for simplicity of construction and to ensure as complete combustion as possible of waste engine oil at high temperature; and, further, so as to be free from the difficulty usually experienced with the simple oil-and-water-flash fire, viz. that it is spasmodic and unreliable in action and requires constant personal attention. It has been fully described above. This burner and the oil and water supply equipment are arranged with the destructor so that the fuel-feed pipe enters through one of the side walls at an angle of 30° from the horizontal, the end of the supply pipe overhanging the burner. The supply pipe itself is thus heated and this greatly assists the atomization and combustion of the fuel.

The following routine has been evolved during the course of experiments with the destructor and during its actual use in a camp:

- (1) Prepare and light the oil-and-water-flash fire.
- (2) See that the urine tray is in the correct position so that the flames pass over and under it.
- (3) (a) Remove the filling lid and empty a charge of excreta on to the burning hearth. It is essential to open the flue damper fully when this is being done in order to prevent back-flushing of fumes. (b) When emptying excreta on to the hearth pour them well forward so that liquids do not overflow over the back edge of the plate on to the fire below. (c) Replace the filling lid; open the draught doors and distribute the excreta evenly over the hearth with the rake. When this is completed, hold the rake in the fire to burn off any excreta which may have stuck to it and then replace it in the tray of cresol provided at the stand by the fuel bins. (d) Close the draught doors and open the air inlet in the filling lid about half an inch. Close the flue damper to about the half-closed position; the flames will then pass both over and under the burning hearth.
- (4) Give the first charge of the day at least one and a half hours' burning with a good fierce fire. Break up the burning excreta with the rake at about quarter-hour intervals in order to assist rapid evaporation of the fluids, taking the same action with the damper as in (3) (a) above whenever the draught doors are open.
- (5) To re-charge, when the contents of the previous charge have become ash, rake sufficient of the ash towards the door end of the burning hearth

in the form of a ridge to prevent any liquids in the new charge overflowing on to the fire; then push the remainder of the ash forwards on the hearth well down the slope towards the urine tray so that it may absorb fluid contained in the new charge as it runs down the hearth. Usually the hearth is hot enough to evaporate most of these fluids at once but whatever may escape runs into the urine tray and is evaporated there.

(6) The fire may be reduced so as to run for about two hours without attention, e.g. during the dinner hour. This is done by adjusting the oil and water supplies when once the destructor has been well warmed up.

(7) After such a period of slower combustion, increase the fire to full flame for about half an hour before introducing the next charge.

(8) The final charge of the day should be filled in about half an hour before the time of shutting off the fire: this gives a good start to the preliminary drying of the excreta and may, with the contained heat of the mass of the destructor, even cause incineration of the contents during the night; these are then available as a dried mass for use (as in (5) above) with the first filling on the following morning.

The experiments in question were carried out during fine September weather without rain. It is possible that, in really cold or wet weather or with very poor quality waste oil as fuel, a lessened degree of efficiency might be recorded. Actually, in a camp, the population of which varied from one hundred to nearly three hundred men, a total of approximately half a ton (1,093 pounds) of solid faeces plus about sixty gallons (579 pounds) of urine direct from latrine buckets was reduced to a residuum of 30 pounds weight of fine, inoffensive, grey ash for an expenditure of 46½ gallons of waste oil as fuel.

Whilst it is clear—and the destructor has been planned with this as one of its “points”—that its supervision and working is not whole-time occupation, it is emphasized that skilled attention is essential both as regards the manipulation of the fire and in the stoking of the excreta. The following programme was evolved during the tests referred to above:

0900 - 0925.—The dried excreta left in the hot destructor overnight are burned off.

0930 - 1145.—First filling—maximum charge—say, 50 pounds faeces plus 20-25 pounds contained urine.

1150 Second filling—ditto.

1200 - 1330.—Dinner interval—decreased fire left burning.

1330 - 1415.—Fire increased to complete combustion of second charge.

1420 - 1645.—Third filling—maximum charge as above.

1645 - 1715.—Fourth filling—ditto. Half an hour's firing, then the fire is extinguished, the damper almost closed and the contents left to dry and burn during the night by the heat accumulated in the destructor.

This routine demonstrated that, under the conditions in which the tests

were carried out, four fillings, each of approximately 50 pounds weight of fæces together with about a couple of dozen pounds weight of urine direct from latrine buckets can be dealt with during an ordinary working day. This, apart from the contents of urine buckets, represents the excreta of some six hundred men. Allowing for variations, incidental delays and so on, it would, therefore, seem reasonable to claim that one destructor of the size and type here described should deal, completely, with the contents of the latrine buckets allotted for five hundred men. It should be possible, also, to deal with reasonable small quantities of normal camp refuse at the same time as the incineration of excreta is in progress in this destructor without interfering with this latter process: this has not, however, been attempted in the experiments which have been described.

APPENDIX.—SCHEDULE OF MATERIALS.

Bricks	500.
Cement	1½ cwt.
Lime (hydrated)	1 cwt.
Aggregate (ballast)	1 cub. yd.
Sand	1 cub. yd.
Iron, corrugated, sheet (heavy gauge) ...	5 ft. by 2 ft. 6 in.
Oil drums	7.
Timber	12 ft. run of 2 by 2 in.
Sheet iron door	2 ft. 6 in. by 1 ft. 9 in.
Sheet iron door, hinged (hanging)	2 ft. 6 in. by 8 in.
Sheet iron door, hinged	1 ft. by 6 in.
Sheet iron door, sliding	1 ft. 6 in. by 1 ft.
Sheet iron lid (heavy gauge) with handle	2 ft. by 1 ft.
Iron pipe with 2 supply holes	¾ in. diam. by 5 ft. min.
Iron bars, T section	4 lengths of 2 ft. 9 in.
Iron barrel or bars 1 in. diam.	4 lengths of 2 ft. 9 in.
Iron pipe, ½ in. diam.	10 ft. run.
Corrugated sheeting, expanded metal, iron bars, odd pieces.	

JOTTINGS ON THE MEDICAL ADMINISTRATION OF AN ARMOURED DIVISION DURING ACTIVE SERVICE.

BY MAJOR E. F. S. MORRISON, M.B.

Royal Army Medical Corps.

It is suggested that, if the work and experience of an armoured division which is operating for the first time under desert conditions should not be recorded, much valuable information would be lost. This information cannot be obtained by any means other than by experience and the officers involved will one and all admit that the unexpected happens in the desert more than anywhere else.

The distance from starting point to extreme limit of operations was, as the crow flies, over 1,300 miles and, except for the first 300 miles, this was over desert. As the division moved, the distance "out" was at least 2,000 miles and the tracks followed were those made by our own track makers. A line of petrol tins was placed along a bearing and after a few vehicles had used it it became a track. Cairns were also used as markers and this combined method was found invaluable. A certain amount of confusion was caused in the early part of the campaign because no method was used to mark tracks and it is expecting a lot of an ambulance driver to find his way, there being often absolutely no "feature" to go by. The fact that individuals know a track does not mean that others also have this knowledge. It is more difficult for an ambulance driver than other drivers because not only has he his patients to consider but he has to keep an extra look out on the going immediately in front of the vehicle.

The whole scope of the tactics was big and a broad outlook had always to be taken.

LIAISON AND COMMUNICATION.

The first essential to medical administration in an armoured division operating in the desert, as it should be on all occasions, is a close liaison with the "G" and "AQ" staffs and in fact with all services. Medical aspects can quite often influence the "G" policy and the closest possible contact is essential. Close liaison means better working and in the clearance of casualties this is essential. The A.D.M.S. and the D.A.D.M.S. were constantly in touch with regimental commanders and also divisional departments.

The "AQ" is bound to be wrapped up in medical matters and smooth co-operation between these two branches will probably take quite a lot of work off the "AQ" branch.

The R.A.S.C. are responsible for the medical vehicles and we must keep on the best of terms with them. They supply us with medical comforts—and

there was always a supply of these ready. They always went out of their way to see that the medical units got what they wanted.

They also supply us with a transport officer and a lot depends on him. If the vehicles do not run then the Light Field Ambulance cannot function. The R.A.S.C. has always been regarded as a welcome part of a Light Field Ambulance and the two services live, we might say, as one. I maintain that an ambulance driver in this last campaign was the chap with whom I would least of all have liked to change places.

The Ordnance have quite a lot to do with the R.A.M.C. and these two services have always got on. They supply us with rot-proof shelters and a word on these will not be out of place. The essential size is 30 by 30 feet and not 20 by 40 feet. The former gives much more working space and, as the comfort and treatment of casualties is the first consideration, these 30 by 30 feet should be supplied. The R.C.O.S. can give invaluable help and an exchange of courtesies—to say the least of it—is most desirable. One finds that throughout the departments all are ready to help the “Medicals”—if the case is put sufficiently strongly to them! Whether it is due to the fact that one day they may be at our mercy I do not know! This co-operation in my experience was marked by noticeable absence of officialdom—essentials were granted forthwith and the haggling, if any, was done afterwards. This is a broad outline of inter-departmental “traffic” at Divisional Headquarters.

While on the subject of liaison a word on communication is appropriate. In this division the Light Field Ambulances have wireless sets. This is entirely due to the enterprise of the A.D.M.S. and practice has shown how invaluable the supply is.

No reliance can be placed on D.R.s operating on motor cycles as these invariably let one down owing to the nature of the ground over which we operate. D.R.s on motor cycles can be useful under certain conditions. The D.R.L.S. is a useful and essential service but calls cannot be made on the R.C.O.S. at all times of the day and night. Throughout the campaign our wireless sets worked without a hitch and, as I have said, time and so lives, was saved again and again. Each Light Field Ambulance had one at its Headquarters and the control set was at Rear Divisional Headquarters where the A.D.M.S. was. There was often no time to write operation orders and signals often took their place. Written confirmation always followed as a matter of course.

A word as regards the position of the A.D.M.S. This campaign showed how complete a reversal of accepted policy took place as regards the function of the Divisional Medical Staff. I should not think a single day passed in which the A.D.M.S. spent more than an hour in his office. This was due to the fact that Rear Headquarters and Advanced Headquarters and Light Field Ambulances were in direct wireless communication and he could be got at in a few minutes. Without these wireless sets at the Light Field Ambulances this movement and liaison could not have been possible

as the D.A.D.M.S. was also frequently out at the same time. We, in this division, found that if the A.D.M.S. was at Rear Divisional Headquarters he was in a better position to supervise the medical arrangements and see the evacuations from start to finish. He was also in constant touch with the "AQ" side, which is the most important one from the medical point of view, but it is most essential that the A.D.M.S. should have a reliable representative at Advanced Headquarters in constant touch with "G." This Medical Officer will have a certain amount of responsibility and will have to make some decisions. The A.D.M.S. will delegate certain powers to him and will depend on him to let him know any new development.

A lot of medical information comes on the forward (Brigade) link which this officer can listen-in to and act upon. In this Division the officer was the D.A.D.M.S.

MEDICAL ESTABLISHMENTS.

The original establishment of an armoured division is two Cavalry Field Ambulances: these have been replaced by three Light Field Ambulances. During the last campaign it was found that two Light Field Ambulances were capable of a sufficient and efficient evacuation of casualties but many situations can be visualized in which the third Light Field Ambulance would be invaluable.

There is support in some quarters for attaching a whole Light Field Ambulance to a Brigade for the clearing of casualties. It is felt that this is most definitely a mistake as the medical administration cannot possibly work in these circumstances and the essential personal link is lost. Our habit has been to attach a section as Advanced Dressing Station to a Brigade but the A.D.M.S. has always regarded Brigade Advanced Dressing Stations as his personal property as much as any other Advanced Dressing Station and has visited them as he has the others. This is the ideal arrangement from the Brigade point of view too and the Brigade Headquarters comes to look upon the Advanced Dressing Station as part of its war-time establishment and its medical officer as one of the most welcome members of the mess.

The existence of three independent unit commanders in a division has its advantages. It relieves the A.D.M.S. of a certain amount of anxiety and these unit commanders have a free hand in the administration of their units. There is a lot of travelling to be done by these Commanding Officers as it may probably take a whole day to visit one Advanced Dressing Station. Only once in the whole of the campaign was it possible for the A.D.M.S. to see all the medical units on the same day—this was when the division was on the point of departing on its race to Benghazi. At any other stage one was lucky if the whole of one unit was seen.

A Light Field Ambulance must be trained to a very high pitch if it is to function well in the desert. For one thing, it has to be absolutely self-supporting. It cannot suddenly say when moving "Oh! I can't fetch my

rations to-day! " If the lorry or truck that normally collects rations has broken down it has to make shift or else go hungry and it hates doing the latter! It must be capable of moving, feeding and sheltering itself and perhaps 100 patients and this last is a tallish order. It must be capable of moving in half an hour and of re-establishing a Main Dressing Station or Advanced Dressing Station many miles away. It must be capable of producing a good meal in fifteen minutes—apropos of this, most members of a desert division are adepts at producing tea almost "out of a top hat"!

All Light Field Ambulance personnel must possess a certain amount of desert knowledge and drivers should all be able to read a map and take bearings for which classes have to be arranged. They must be instructed in any method that may help them to find where they are. A slight knowledge of the stars is invaluable and lessens the strain of night movement in the desert.

DISPERSION.

One fact that new arrivals treat lightly at first, but later not so lightly, is the dispersion of a unit in the desert. This must be both intra-unit and inter-unit. Protection from air attacks has to be one's first consideration and this is obtained in three ways:

- (i) Choose your site from a "camouflage" point of view, using the nature of the ground to help you, i.e. a patch of scrub as opposed to bare desert.
- (ii) Disperse your vehicles—at least 200 yards between each.
- (iii) Dig slit trenches as soon as your site is chosen. These should be about 4 feet deep, about 20 inches across and each arm about 6 feet long—arms being at right-angles to each other.

If you carry out these three elementary precautions thoroughly your fear of casualties from air attacks will be reduced to a minimum. It is comforting to know that, in the last campaign a bomb, dropped in one arm of a slit trench, killed all the people in that arm but left the people in the other untouched. Slit trenches have reduced the effectiveness of bombing more than anything else.

Dispersion is good because it produces exercise which otherwise would not be taken as well as in other ways. In a Light Field Ambulance the outside vehicles of the leaguer will be at least a mile apart—which means that a considerable amount of exercise is taken during the day by conscientious officers.

There is bound to be a good deal of traffic in a Main Dressing Station and so care has to be taken as regards track making. Nothing gives away positions more than tracks. A flip in a plane will convince anyone how important it is to avoid making them. They can be seen for miles. If a Main Dressing Station is stationary for any length of time it will be difficult to avoid making a certain amount but these should be reduced as much as possible. No vehicles other than the barest necessary minimum

should be allowed to travel inside the area. If they want to go to the other side then they should go round.

Great care must be also taken in choosing a site from the wind point of view. A camp situated down wind of a dusty track will obviously be very uncomfortable. A lot of little things can influence the comfort of living in the desert.

Field Ambulances must be prepared to operate as isolated sections and not as a whole. Every section is capable of working alone and will be called upon to do so.

Life in a Field Ambulance can be both dull and exciting when operating in the desert. When the division is fairly static and there is not much doing in the way of fighting then all that comes through is the normal sick.

If a division is acclimatized to a desert then the sick rate will be extraordinarily small. The average sick rate for the whole campaign in the Western Desert of the —th Armoured Division was much better than anyone could have anticipated.

At other times life is hectic. Take two occasions in this Campaign. One was the battle of Sidi Barrani when we had 300 casualties of all sorts, British, Indian, etc., through our Advanced Main Dressing Station in one night between 11 p.m. and 5 a.m. This was a difficult time but all went smoothly. The second was at Soloch when prisoners of war wounded poured in to the tune of 400 or so—this also entailed a lot of work. But these rushes came as a matter of course and one looks back on them with relish. Everyone loves to feel that he is doing a job of work. The Italian Medical Officers were most helpful in dealing with their wounded. One rather gruesome handful of wounded that was dealt with was a collection of Bedouins who were dive bombed and machine-gunned by German planes—a sporting encounter from the German point of view.

During quiescent periods time does hang a bit heavily, especially for isolated Advanced Dressing Stations, which may be anything up to 30 miles from their nearest neighbour. The officer here feels it more than the men. There is very little to do in the way of entertainment, etc. and, after every friend has been written to, time goes slowly—darts, cards, dominoes, all help to pass the time—one turns in at dusk and if one is lucky one sleeps for twelve hours.

It has always been the policy in this division to change an isolated section fairly frequently—a month at a time is long enough. If this is done, the change is regarded more as a holiday. This does not apply to Advanced Dressing Stations attached to Brigades. Each Brigade has a Section of a Light Field Ambulance attached to it which moves under Brigade Orders. The A.D.M.S. arranges all evacuations behind these Advanced Dressing Stations.

DESERT WORTHINESS.

This means, to a lot of people, merely that one's car has to be running well, that the driver is fit and that one is also fit oneself. They think

that, if these provisions are complied with, the "outfit" is fit for desert traffic.

Now the more one sees of the desert and the more one goes about in it the more convinced one becomes that liberties cannot be taken with it. If liberties are taken, then grief only can result, sooner or later and probably sooner. The desert can be very friendly but it can also be the most inhospitable and unfriendly and revengeful host in the world. Treat it right and it will probably treat you right! Now for desert worthiness:

A vehicle must have: (i) Low pressure tyres; (ii) sand tracks; (iii) sand mats; (iv) a radiator condenser. Without these four essentials one is bound to come to grief sooner or later.

Now for vehicle equipment: (1) A compass is essential, be it oil, sun, or prismatic. It is ideal if a sun compass is fitted and one of the occupants has an oil compass. This latter sort is much steadier than the prismatic. (2) A good scale map follows as a matter of course. (3) A protractor, ruler and pencil are each a *sine qua non*; chinagraph pencils are invaluable too. (4) A torch is a great asset. (5) Almost the most important thing is the three days' vehicle rations which must not be touched until the passengers have been for a day without food (!) and at least 12 gallons of water. Spare petrol and oil are a matter of course. As regards personal equipment, one's comfort should guide one. As one may have to spend the night in the desert a bed-roll will add to one's comfort and so that should be taken.

Anyone doing a trip across a desert must know how to navigate and the snags in it. For instance navigating in a Ford Utility Car is full of difficulties. The coil is situated so high up that when navigating from the front seat, especially on an East and West bearing, one may be anything up to 25° out. In the back seat one will not be more than 10° out but exact navigation is essential and, to ensure this, the selected bearing must be taken out of the car and the variation noticed from inside; adjustment can thus be made but outside bearings must be taken from time to time. Navigating in daylight is perhaps difficult at times but navigating at night without lights is much more so, to say nothing of the fact that one may pass within 50 yards or less of one's leaguer and miss it! When navigating one must put one's complete trust in compass and speedometer which one has previously checked. A slight knowledge of the stars is a great help at all times. This, then, is a brief outline of the minimum amount of desert worthiness with which a possible desert navigator must be equipped. Even then, he'll be lost temporarily at times—by this I mean—not lost but not knowing where he is.

REGIMENTAL MEDICAL OFFICERS.

A Regimental Medical Officer is either a gift from God or a curse from his own, his regiment's and the medical services' point of view. He is the

first link in the chain of evacuation. The A.D.M.S. must know all his Regimental Medical Officers well and they are his first consideration. He attaches an ambulance car to each Regimental Medical Officer and he uses it to evacuate to the nearest Advanced Dressing Station, usually the one attached to the Brigade of which the regiment is a component. This car does not belong to the regiment and may be withdrawn at times by the A.D.M.S. if he runs short. Regarding ambulance cars, this division was lucky enough to be able to create a small pool of six cars under the absolute control of the A.D.M.S., but these were soon used up. The number, fourteen, attached to each Light Field Ambulance was not at times sufficient as the Regimental Ambulance Cars were supplied out of this number. It meant that the personnel was grossly overworked at times.

EVACUATION OF CASUALTIES.

This may or may not be a problem—dependent almost entirely on the nature of the ground to be covered. Distances will probably be long and so it will take time for cases to get back to, shall we say, a Casualty Clearing Station, but if the going is good then the patients will not suffer much discomfort.

The following is an instance of the line of evacuation at one moment in this last Libyan Campaign. Say a man was wounded while in a mobile unit operating far ahead as these divisional units always were.

He probably had 50 miles back to his own R.A.P. (Going bad.)

He probably had 25 miles back to Brigade A.D.S. (Going bad.)

He probably had 30 miles back to A/M.D.S. (Going very bad.)

He probably had 30 miles back to Staging Post. (Going almost impossible.)

He probably had 50 miles back to M.D.S. (Going almost impossible.)

He probably had 60 miles back to Railhead. (Per Motor Ambulance Convoy.)

He probably had 80 miles back to C.C.S. (Per hospital train.)

He probably had 150 miles back to General Hospital. (Per hospital train.)

This means, any way, a trip of 500 miles, at least 185 miles of this being over bad going and about 80 miles over almost impossible going where ambulance cars are reduced to 5 m.p.h. sometimes and sometimes to a standstill for the way to be cleared. This clearing takes a lot of doing and means, more or less, an endurance test for the drivers. A good ambulance driver who can find his way about the desert is a man of parts—to say the least of it.

Valuable work is done by staging sections. Patients are apt to get uncomfortable during long journeys over bad going and a tactful competent senior N.C.O. in a staging post can make all the difference—adjusting bandages, etc., and providing, perhaps hot soup or tea which are always

on tap in all the divisional medical units. A little sustenance puts a patient in a happy frame of mind automatically.

Air evacuation is, of course, the ideal but here we have an old and much thrashed out point. The —th Armoured Division used it on several occasions but the benefits acquired by isolated air evacuations were of very doubtful value. It is a debatable point whether one badly wounded man is as valuable as a 100 per cent airplane with its 100 per cent crew. The heroic attitude gets one nowhere in war—attractive as it may be to one's vanity.

SURGERY IN THE FIELD.

Everyone is always very keen that surgery should be done as early as possible and both the —th Armoured Division and the —th Australian Division developed this and, while the war took the form of attacks on certain objects the capture of which would be followed by quiescent periods, these surgical centres worked pretty well, e.g. Bardia and Tobruk.

However it was quite obvious in the latter part of the campaign that a surgical centre, if attached to a Light Field Ambulance, would be a menace in a fast moving war—either backward or forward.

"When circumstances permit" must play a large part in the establishing of an operating centre.

Mobility is one of the absolute and most important essentials of a field medical unit.

MEDICAL STORES.

Medical stores did not run out at any time during the campaign. This was due to these factors: (i) Each Light Field Ambulance had a small reserve on its own account. (ii) A reserve had been accumulated at Rail-head. (iii) Large amounts of enemy medical stores were captured.

Enemy medical stores are on the whole, fair. Their medical instruments are nothing like as good as ours. Most of their drugs are in ampoule or tablet form and produced rather expensively. Huge amounts were captured and these all helped in treating wounded prisoners of war. Stretchers were not always in as large numbers as we would have liked but this was probably due to the illegitimate use to which they were put in non-medical units.

PREVALENT DISEASES.

(1) *Inflammation of Skin and Areolar Tissue*.—This is nothing new and has been found in nearly all the troops operating under desert conditions with limited chances of washing themselves or their clothing. This eruption takes the form of a varying degree of septic inflammation. Minor traumatic abrasions occur first and then one has only to think of what is lying about in the desert waiting for a wind to arise to blow it into these abrasions! The wonder is that the lesions are not more often severe.

Added to this is the desiccated condition of the skin and the acute streptococcal form with lymphangitis sometimes supervenes on the chronic ulcerating varieties.

Various forms of prophylaxis and treatment have been tried and each method has its adherents but no treatment stands out as the accepted one. Supplementary medicaments have been added to the normal list, in order to try these out, but no definite results have been reached. Sufficient is it to say that a return to normal hygienic living results in an immediate cure. One thing is definite and that is that the lack of vitamins is not the cause.

(2) *Gastro-enteritis*.—Another disability which became a nuisance was gastro-enteritis. This was usually of a mild type and responded to accepted treatments. Often the patients were nearly well when they reached hospital but at the start of the illness they were too ill to be kept in their units.

(3) *Catarrhal Jaundice*.—Almost an epidemic of this occurred—it may have been due to one of two things.

(i) A liver in a sluggish state due to the enforced lack of exercise in an armoured division. It was chiefly among the "leisure" classes that it appeared, i.e. those that did not dig their own slit trenches!

(ii) Chills. The desert nights are very cold and a shirt that has been sweated into all day feels exceedingly chilly at night. Sitting in draughts, as in an office truck, would also lead to this and make the disease look almost epidemic.

Nevertheless the general sick rate, including these three complaints, was extraordinarily low.

LESSONS FROM THE CAMPAIGN.

The main lessons from the campaign were:

First.—The absolute soundness of the principle of organization that units must be designed and trained for the most difficult operation they may be required to undertake has been clearly demonstrated.

Administrative arrangements in all the preceding operations had been modifications of the rules to meet an easier situation than that for which the system was designed. If the system had been designed for an easier and more normal operation it could never have been modified at the last minute to cope with a more difficult undertaking. The lesson is, then, that we must organize for the abnormal, for the most difficult, rather than the normal which is simple.

Secondly.—That successful administration in an armoured division in the desert depends on sufficient transport is self-evident. There is practically no obstacle to the passage of any number of vehicles. In a theatre of war in which movement is restricted by the terrain, the larger the number of vehicles the more difficult the movement becomes and the operations and the size of the force employed must be limited to the communications available. The abortive dash to Slonta proved this.

Thirdly.—It is clear that wireless communication for all administrative units is essential. Difficulty of communications and lack of transport were the only limiting factors in the conduct of administration. A unit in the desert without wireless is uncontrollable.

These notes represent the medical aspect of the administration of an armoured division and do not in any way pretend to be complete. It would take up several volumes to deal thoroughly with the whole situation. It is however hoped that these jottings may induce officers of the R.A.M.C. to take special interest in a side of the medical services which will, no doubt, be very prominent as the war goes on and which offers an enormous field for activity in construction, the exhibition of individuality, and adventure. Without the example of the A.D.M.S., who was magnificent throughout the campaign, embodying drive with thoroughness as he does, things would not have gone as smoothly as they did. My thanks are due to him for all the help he has given me, both in the field and in the perpetration of this effort.

ASTHMA IN THE BRITISH ARMY.

BY MAJOR CHARLES SUTHERLAND.

Royal Army Medical Corps.

DURING the past two years large numbers of soldiers have been discharged from the Army on account of asthma. Many of these were well trained men in responsible positions and these discharges represent a serious loss at a time when the question of man power is becoming acute. In addition there are many soldiers still in the forces whose efficiency is being reduced by more or less frequent attacks of asthma.

The outlook in asthma is regarded with pessimism by many physicians and this probably accounts for the lack of effort to deal effectively with these cases which is manifest at present. It is often held that the chance of cure is remote, that the patient will break down just when some crisis arises and that it is better to discharge him if one or two severe attacks have occurred.

It is sometimes not realized that there are several distinct types of asthma and that a majority of those asthmatic subjects who get into the Army suffer from a kind which frequently responds well to treatment. There would seem to be no doubt, therefore, that much more could be done to render these men effective although the prognosis admittedly depends on such factors as climate, environment, associated diseases, diet and on the keenness of the patient to get well.

Another misconception is that investigation and treatment are complicated. Some obscure types do require complicated investigations and, if encountered, are better discharged, but the type met with commonly in the Army can be effectively tackled with quite modest equipment and with a minimum expenditure of time. At present these cases are scattered in twos and threes throughout many hospitals so that it is not worth while for anyone to get together the necessary equipment. If they were collected into one or two centres a large number could be handled with much less effort and much greater efficiency.

TYPES OF ASTHMA.

Cases may be divided into (a) those in which "extrinsic" factors such as pollens, dusts and animal emanations determine the onset of attacks, and (b) those in which the determining factors (chronic infection, reflex irritation from nasal polyps, etc., or more obscure causes) seem to lie inside the patient. In the "extrinsic" cases, attacks naturally vary with changes of season or environment and skin tests show reactions to pollens, dusts, etc., whereas, in the "intrinsic" cases, environment and season have little effect on the incidence of attacks, skin tests are usually quite negative and associ-

ated diseases of the nose or bronchi are much commoner. The prognosis in the former ("extrinsic") type is generally infinitely better partly, perhaps, because the causes of the attacks are more clearly defined and it is fortunate that, among civil patients, about 70 per cent are of this type. In the Army the proportion is even higher because the intrinsic type tends to be severer and to occur among older patients so that they don't get into the Army.

THE CAUSES OF ASTHMA.

The dyspnoea of asthma is due partly to swelling of the bronchial mucous membrane and to the secretion of rubbery sputum but mainly to bronchiolar spasm. This may be produced reflexly by irritation of a sensitive area or by the local action, in the muscles, of histamine-like substances produced by the absorption of allergens: no doubt other causes of spasm will be discovered later.

When hypersensitiveness (or allergy) is the precipitating cause, gross exposure to the specific allergen will cause attacks and complete absence of the allergen (e.g. in the pure air of mountains, oceans and deserts) will give complete and lasting freedom. Skin tests almost invariably give marked reactions which fit in beautifully with the history. However this is not a complete explanation because many hypersensitive individuals who are constantly exposed to moderate concentrations of their specific irritant, get periodical attacks as if some other variable factor (some biochemical "tide"?) played a part. At present the known facts can, perhaps, be best expressed by saying that *all* asthmatics are unduly responsive to many different stimuli (chemical, thermal, mechanical, pharmacological, psychical, etc.) and that, in a large proportion, the most obvious stimulus is an allergic one.

The allergic hypothesis has come in for some well-merited criticism because of its over-emphasis by some enthusiasts but some of the critics have themselves been misled by the use of poor testing reagents so that they have grossly underestimated the incidence and significance of allergy. Poor therapeutic results also are often due to lack of thoroughness in dealing with environment and to the use of feeble protein extracts in attempting specific desensitization.

This question of the potency of protein extracts is very important and it is regrettable that some of the commercial extracts are either feeble or inert. A good extract should be quite inert when applied to a scratch on the skin of a normal individual and should produce a large, irregular itching wheal when similarly tested on the skin of a specifically hypersensitive subject. Some liquid extracts rapidly lose activity and, until more reliable preparations are available, it is generally better to use dry, sterile, defatted powders prepared from the crude proteins (animal danders, feathers, kapok, orris root, linseed, house dust and pollens) by repeated washing in fat solvents such as toluol, carbon-tetrachloride and ether. A

drop of alkaline saline is applied to each "scratch" and the powder mixed to a paste on the spot. Intradermal tests are only necessary when it is impossible to obtain potent test reagents. For example, it is sometimes difficult to prepare satisfactory extracts of feathers, sheeps wool and orris root.

INVESTIGATION.

Effective treatment is possible only when the real causes of a malady are defined and then assessed at their relative importance. Much investigation can be done which, perhaps, is useful in excluding associated diseases but which does not succeed in bringing to light the really important factors. Thus asthmatic patients often undergo repeated careful clinical examinations assisted by radiology of the chest, sputum examinations, E.N.T. examinations, blood sedimentation tests, etc. and yet the poor results of treatment strongly suggest that the real cause has been missed. The direction which investigations take is largely determined by the theories the investigator holds and, in the present state of knowledge, there is no doubt that the allergic aspect must be investigated. Whatever its defects, the allergic approach does often give dramatically good results and there must be few physicians who have really tried it on a large scale who would disagree with this.

From a military point of view the ideal is to define the causes by simple means, to apply the best treatment thoroughly and to return the soldier to complete health in the shortest possible time. If complete cure is impossible, his future capacity must be gauged and he must be placed in the most suitable category and instructed how to maintain his health.

Investigation involves a very detailed history, a thorough examination assisted by appropriate measures to exclude associated diseases, examination of a very fresh specimen of sputum for cells, bacteria, etc., thorough examination of the nose and throat and tests for hypersensitiveness. Thorough tests might require the use of over sixty reagents but, in a majority of cases, as few as twenty tests are sufficient. Occasionally something important will be missed but the time wasted in the routine use of large numbers of extracts would seldom be justified. But it is critically important to use only extracts of known activity and to apply them skilfully. Testing should be done in a good light and, if there are many cases, it is far better to train a technician or nurse in the work so that the physician is left free to deal with other aspects.

Generally a well taken history and the routine clinical examination will distinguish between asthma and bronchitis but, when there is doubt, auscultation of the chest before and twenty minutes after an injection of adrenalin gives valuable help. Obscure cases of bronchitis should always be tested with adrenalin and a few of the important allergens as an appreciable number turn out to have an allergic cause and respond well to treatment once this is defined.

TREATMENT.

Although the factor which precipitates attacks must be defined and dealt with, it is very necessary to take a wide view and to treat the patient rather than to attempt to treat only one aspect of the disease. Occasionally no obvious single factor can be defined and yet, when the patient's health is improved by attention to diet, environment, psychology, exercise and general routine, the attacks cease. Unfortunately this is not often sufficient and a more concentrated attack must be made on one aspect. Poor results in treating obvious allergic cases are commonly due to (a) failure to attend properly to the patient's environment, (b) the use of poor quality protein extracts when attempting specific desensitization and (c) unskilful dosage and lack of persistence.

Even severe attacks, if due to extrinsic factors, subside promptly in a clean, dry atmosphere so that admission to hospital is indicated in severe attacks. The patient then remains free of attacks during his stay in hospital but relapses on returning to a relatively dusty billet. All cases with this sort of history so far tested have shown marked sensitiveness to house dust and, presumably, the dust in hospitals is less plentiful or less irritant than that in billets. It is in these cases that desensitization is so necessary as, under Army conditions, it is sometimes difficult to do much to reduce dust in billets.

In civil life, desensitization may require from three to six months but sometimes "rush" treatment is possible, giving the initial, small doses every few hours and the larger doses every day or so, so that the final dose is reached in two or three weeks. But there is an optimum time for the assimilation of each dose and, in some cases, days must elapse before another large dose can be given. This time factor is possibly the greatest difficulty in treating soldiers but it is far better to give as few as ten desensitizing doses spread over a fortnight rather than not to attempt treatment at all because even a few effective doses will produce striking improvement for months.

To make sure that the extracts which are to be used are really potent one drop of the strongest concentration should be applied to a scratch on the forearm: a good extract will produce a large, irregular, itching wheal within ten minutes. If it does not, it is simply a waste of time using the extract.

During treatment, effective doses will produce itching, redness and swelling at the site of injection within an hour and, during the next few days, will considerably raise the patient's tolerance so that the next dose may have to be doubled to produce the same degree of local reaction. When potent extracts are being administered to very sensitive subjects care must be taken not to give an overdose and the size of the local reaction must be the main guide in deciding on the size of the next dose.

NON-SPECIFIC THERAPY.

Non-specific therapy with agents such as peptone, milk, tuberculin and vaccines is sometimes very effective but there appears to be no way of deciding beforehand whether or not it is likely to succeed. The results therefore do not compare in reliability with those of specific desensitization. However it is often worth trying when no obvious allergic factor is found. Vaccines probably act in a non-specific way and a mixture of pneumococci, streptococci, *B. influenza* and staphylococci in a total concentration of about two thousand million per cubic centimetre is often most useful. It is important to use small doses, starting with one minim and increasing very slowly at intervals of five to seven days.

DRUGS.

Any full discussion of the use of drugs in asthma would be out of place here but one or two points should be emphasized. Some cases improve surprisingly with full doses of iodides and, subsequently, a small dose suffices to maintain that improvement. When attacks persist in spite of treatment, they can often be controlled by the inhalation of adrenalin (1:100); or the patient may be taught to inject adrenalin (1:1,000). Thousands of asthma patients in civil life are able to carry on with this aid and it seems surprising that really useful men in the Army are not encouraged to do the same. It is a curious fact that more than half of the asthmatic soldiers examined had not even heard of adrenalin. Ephedrine, of course, is used extensively but is a relatively feeble and unsatisfactory remedy.

ADVANTAGES OF SPECIAL CENTRES FOR TREATMENT.

In civil practice the advantages of special clinics for investigation, treatment, instruction and research have become very obvious and many of the same arguments apply in military practice. Attempts to deal with widely scattered cases are laborious, time consuming and not very effective. If these cases were collected into one or two centres it would become worthwhile to assemble the necessary equipment and staff and, helped by such an organization, one physician could handle, more effectively and with much less effort, large numbers of patients. In civil hospitals, such centres become of great use to dermatologists and otologists in elucidating obscure cases of contact dermatitis and chronic nasal disease and, in the Army, they should prove equally useful. Many cases of chronic, non-febrile bronchitis could also be reviewed with advantage at these centres.

A SURVEY OF FIFTY UNSELECTED CASES.

During the past few months fifty unselected cases (eight officers, five N.C.O.s and thirty-seven other ranks) have been studied. Time and facilities were limited but, in each case, at least five tests with some of the

more important allergens were made. In forty-five the history suggested that extrinsic factors might be important and, in all of these, skin tests showed some form of sensitiveness. Many, of course, reacted to several different substances. Forty-one reacted to house dust, twenty-four to feathers, four to horse dander, five to linseed, eighteen to grass pollens, one to mustard, one to kapok and one to *trichomonas vaginalis*. This high incidence of allergy (90 per cent) is remarkable because, in civil practice, it is rare to find more than 70 per cent hypersensitive. However the severest types of asthma seem to occur among the non-allergic cases and these, and cases complicated by other diseases, are eliminated when they attempt to enlist. This would account for the fact that in only three of the cases was there any obvious nasal disease.

In a number of cases rapid desensitization was attempted by giving injections of the appropriate extracts each day at first and then at longer intervals as the doses increased. Even after three weeks a marked increase in tolerance was produced but no useful assessment of the efficacy of treatment can be made until the cases have been observed for at least twelve months. However, in many cases, attacks have been much milder and less frequent and, in several, attacks have suddenly ceased.

CONCLUSION.

A survey of fifty cases of asthma occurring in the British Army shows that almost all suffer from a type in which treatment is generally very helpful. It is suggested that more effective steps should be taken to treat these cases and that they can best be dealt with in special centres.

OCCUPATIONAL THERAPY.

BY MAJOR G. D. KERSLEY, M.D.,
Royal Army Medical Corps.

THE statement of Galen that "employment is nature's best physician and is essential to human happiness" has become almost a platitude. Yet occupational therapy is really the application of Galen's principle to modern therapeutics by utilizing crafts, trades and games in order to hasten the return of the sick and injured to a state of health in which they will be of the maximum use to the community. It is the prescription of work for specific therapeutic purposes. As but few Medical Officers have so far had much experience of occupational therapy, it has been suggested that a short summary on the subject might prove useful.

Occupational therapy has two sister schools—diversional training, or diversional occupation as it is sometimes called, and vocational training and guidance.

Diversional training consists of the use of crafts and games to maintain general body activity, stimulate interest and prevent boredom. By this means recovery may be expedited and a more favourable mental attitude maintained after physical recovery, especially in cases requiring prolonged convalescence.

Vocational training and guidance is the selection of suitable trades for disabled men and their training in those trades.

In both of these schools medical supervision is obviously necessary but in the former much of the work can be carried out by the Army Education Corps and voluntary workers. In the latter the Ministry of Labour and Ministry of Pensions are primarily concerned.

Occupational therapy itself is entirely a medical problem though it can be subdivided, with of course much overlap, into two main spheres, physical and psychological.

The value of occupational therapy as we know it to-day was first recognized during the last war and is extensively written up in the American History of the Great War. The British Association of Occupational Therapists was not however formed until 1936 and the work at first was developed more in the psychiatric than the physical field.

In the treatment of mental illness, apart from the large personal factor of the patient's interest, crafts may be chosen that are largely stimulating or sedative. Some colours for instance have definite stimulating or sedative properties. Some crafts need much concentration and contain much detail or are extremely simple. Some entail a variety of processes and give scope for initiative while in others the appeal may lie in the production of a personal luxury or of an article that will be of value to mankind.

Major Fraser in a recent lecture classified personality types and their breakdown into four common groups: (1) The Schizoid—the solitary introspective individual—often imaginative and artistic—frequently has a subconscious feeling of guilt as the result of his self love. He has a lack of external emotion and tends to withdraw further and further from the outside world. He should be strongly encouraged in his personal project in order to engender the creative spirit and bring out some emotion of interest and love for the result of his labours. (2) The Cycloid, who is moody; sometimes on the top of the world and at others in the depths of despair; often also has his emotions, especially aggression and love, repressed by an over-strict conscience. He again requires much encouragement but is more likely to choose to make an article of use to humanity as an atonement for his subconscious guilt sense. (3) The Obsessional, again, has a deep guilt sense but is over compensated and is usually over conscientious. He is a hard worker and good at detail. He is liable to breakdown with lack of concentration. He should not be hurried in his work; the drive will return in due course. Relaxation should be encouraged. Work entailing much detail and likely to be of value to the community will probably be chosen. (4) The Hysteric, always an extrovert, a good mixer with plenty of drive, is likely to breakdown with a physical symptom such as a paralysis or loss of memory. He will be easily interested in a craft which will assist in improving his general outlook on life.

In the more important physical or orthopædic field, crafts are chosen for the specific purpose of increasing the range of movement in a stiff joint or building up certain muscles and re-education after paralysis; in fact carrying out remedial exercises in the process of plying a craft or playing a game.

There are arguments for and against the use of occupational therapy or remedial gymnastics. Occupational therapy needs more apparatus and a more fully equipped department and many of the movements are less specific. But, in addition to the psychological advantage, and there are few serious injuries without at the same time a vestige of mental trauma, for which occupational therapy may be cited: (1) the larger part of the day during which the movement is being carried out, the mental fatigue element of repeated remedial exercises being eliminated; (2) the use of unconscious movement not calling attention to the injured part together with the coupling of the required movement with other movements producing a gradual return towards the conditions of normal life; (3) the value of the project in some cases and, more important still, the instruction in what may later become a new hobby or even a trade.

Remedial exercises, games and occupational therapy all have their uses. In a given case it is impossible to say which, or which combination, will be most satisfactory until the individual's interests and attitude are known. One man may slack at apparatus work and complain of pain in remedial classes; yet in pursuit of a craft he may persevere with the painful

movements and almost forget his discomfort. A second may hate any kind of craft work but fall an easy prey to competitive games. A third may perform well in the remedial gym but consider all occupations and games a waste of time. On the whole it may be stated that in the early stages of treatment the physiotherapy department holds sway but later occupational therapy comes into its own.

In applying crafts or games to physical treatment firstly a detailed craft analysis is needed for each piece of apparatus or tool used. This entails a knowledge of the joints moved, actively or passively, the muscles used, actively or statically, and finally the most common clinical applications.

In order to obtain the maximal physical benefit from an apparatus it may frequently have to be modified. The apparatus most economical from the point of view of labour is seldom the best for building muscle. Take for instance a loom. The optimum curative posture for the individual concerned may require that he lies on a couch and works from below, stretching upwards to do the work, and moreover the beater may be attached to weights over pulleys in order to increase the work done in pulling it up. A lathe or fretsaw may be operated by a treadle for maximal ankle movement or by a bicycle-like drive to concentrate on the knee and hip movement and building up the quadriceps.

Similarly the tool used may be varied according to the movement required. The weight of a particular tool, the hardness of the material and the length of the stroke (e.g. in planing) all vary the mechanics of the action.

The project itself is chosen with a view to the movement and strength of movement required. Thus the making of a Chinese checkers board entails much use of the brace and counter sink and wood work may be decorated by a pattern of screws (for pronation and supination) or embossed with nail head marks for a hammering exercise.

Either men or women may be trained in occupational therapy but in many ways the latter are more suitable except for overseas, Prisoners of War Camps and where heavy crafts are to be taught and here a technician may be employed under the occupational therapist. As a war-time measure the course of two and a half years has been shortened to six months for partly trained personnel such as masseurs, mental nurses and arts and crafts teachers, who must then specialize either in the mental or physical aspect of occupational therapy.

In addition to the Army Centre at present training R.A.M.C. masseurs, the training of women is also in progress for E.M.S. and private entrants at the Dorset House Centre, Barnsley Hall, Bromsgrove, and the Astley Ainslie Institute, Edinburgh, while the London school is about to reopen.

At the Army Centre the Command Specialist in Physical Medicine is supervising instruction in anatomy and physiology, elementary medicine and surgery, orthopædics and psychology, theory and application of occupational therapy and department management. In addition the following

main crafts are taught; carpentry, tinsmithing and sheet metal work, painting, wood finishing and lettering, basketry (light and willow), leather work and glove making, weaving, rug making and cord knotting. Where possible a war utility aspect is introduced e.g. by teaching splint making (metal and leather), red cross pannier making (willow basketry) and camouflage netting.

In the treatment department attached to the Centre cases with physical or psychological abnormalities are seen and assessed by the specialist in conjunction with one of the occupational therapists and the most suitable craft and also the project in that craft are selected for him, bearing in mind at the same time his interests. Moreover the type of material and tools is selected and modified so that he may obtain the greatest physical benefit from his labours. The R.A.M.C. trainees after they have learnt the crafts are present at such consultations and then assist in instructing the patient along the lines prescribed. By careful recording of progress and graduation of work the patient is steadily and happily led to more vigorous work for the affected part but the work is introduced in such a way that the movements become unconsciously a normal and natural part of everyday life rather than a somewhat guarded and thought out part of a treatment.

One cannot over emphasize the necessity for a clear conception of the uses of Occupational Therapy both for promoting physical recovery and as a means whereby disabled men may regain their self respect and once more become useful citizens.

Editorial.

A BIO-CHEMICAL STANDARDIZATION LABORATORY FOR INDIA.

THE want of a Standardization Laboratory for India has been severely felt in the past. The Drugs Enquiry Committee (1930-31) made as one of its most important recommendations that "firstly, an all-India legislation should be passed for the control of the importation, manufacture, sale and distribution of adulterated and under-strength drugs and, secondly, a machinery should be set up for the regular collection and testing of drugs to ensure conformity to proper standards of purity and strength."

That recommendation set forth the vital necessity, to a great nation supplying the crude products on which the manufacture of medical and other scientific supplies are based, of a laboratory in which proper standardization could be carried out and further envisaged the provision of numerous standard products for the still wider market offered to India by, for instance, such an event as the European war in which we are now engaged.

It was not until 1937, however, that the nucleus of a Central Laboratory was established in Calcutta "as a first step towards a more elaborate organization" to be developed later. The Chairman of the Drugs Enquiry Committee, Brevet-Colonel Sir R. N. Chopra, C.I.E., M.A., M.D., Sc.D.Cantab., F.R.C.P.Lond., etc., I.M.S. (R.), who was also designated as the future Director of the Laboratory, had been permitted, in 1926, to visit England and America to study similar institutions already in existence, and had made valuable contacts with Sir Henry Dale, F.R.S., N. L., Director of the National Institute for Medical Research, Hampstead, Dr. P. Hartley, F.R.S., Dr. J. H. Burn, M.D., Professor of Pharmacology at Oxford, Professor C. W. Edmunds, M.D., the University of Michigan, Professor C. Voegtlin and Dr. Irwin E. Nelson, and many other scientists. After his return Sir R. N. Chopra submitted to the Government of India a provisional scheme for the initiation of a Pharmacology and Bio-Assay Section and a Pharmacology Section. The work of a Bacteriological Section was not envisaged, the existing one at the Central Research Institute of the Government at Kasauli being regarded as sufficient.

In February, 1937, negotiations were started with the Director of the All-India Institute of Hygiene and Public Health with a view to the taking over of a section of the unoccupied floor space of the Institute and, as was to be expected, were successfully carried through. The work of purchasing and installing the special apparatus and equipment, ordered from England, Germany and America, occupied succeeding months and, by the end of

September, after a strenuous but wonderfully prompt assembly of the more urgently required necessities, the Laboratory was able to start experimental work. Access is already available to the libraries of the All-India Institute, the School of Tropical Medicine and the Presidency College, University College of Science, and the Government Commercial Library and, in addition, the Laboratory has the nucleus of a library of its own. In addition there is the Drug Museum, a section which is likely to grow rapidly with the collection of types of spurious, adulterated or under-strength drugs and chemicals which prove to be of especial interest. "Work in this connexion was started nearly a year ago and arrangements are now in hand for exhibiting such specimens properly in glass cases."

The functions of the proposed Laboratory were set forth in the report of the Drugs Enquiry Committee (1930-31) as follows:

- "(1) to do research work on the pharmacological testing of drugs;
- (2) to train public analysts in the methods of chemical, bio-chemical and biological assay;
- (3) to undertake commercial testing of drugs for manufacturers and dealers on payment of prescribed fees, particularly for those who are unable to set up their own laboratories for testing of their products;
- (4) to prepare and maintain stable standards of strength, purity and quality for drugs;
- (5) to standardize methods of analysis and tests with due regard to the climatic and other conditions prevailing in different parts of India;
- (6) to guide, co-ordinate and correlate the work of the Provincial Government Laboratories;
- (7) to act as expert referee in respect of disputed analyses of samples sent by the Provincial Governments;
- (8) to periodically issue bulletins about its progress in various branches of activities and supply information to manufacturers and Provincial Laboratories, such as they may be in need of; and
- (9) to assay and test chemicals, drugs, biological products and organo-metallic compounds on request by any person including local Governments, Provincial Laboratories or Inspectors."

The Central Government was to introduce legislation for the control of imported drugs. The control of the manufacture, sale and distribution of drugs was left in the hands of the Provincial legislatures.

That the Bio-chemical Standardization Laboratory is gallantly proceeding to undertake all this and other work of a pharmacological nature is made clear in this Triennial Report. "As many as 163 samples of digi-

talis preparations, the majority of which were in the form of the pharmacopœal tincture, were received for bio-assay during the period from 1937 to 1939.

Of these samples tested by the 'cat method,' only 22·08 per cent, which were found to be within the prescribed standard, could be regarded as possessing the required concentrations of the active glucosides necessary to bring about the desired clinical effect. About 14 per cent. of the samples were found to be either completely inert or weak in potency to such an extent as to be almost completely valueless as therapeutic agents." This affords an excellent sample of the kind of work being done. To such analyses is the Laboratory devoting itself and its success is sure to make it an outstanding department of Indian Research as well as controlled commercial activity in the future.



Clinical and other Notes.

AN IMPROVED DIRECTING LAMP.

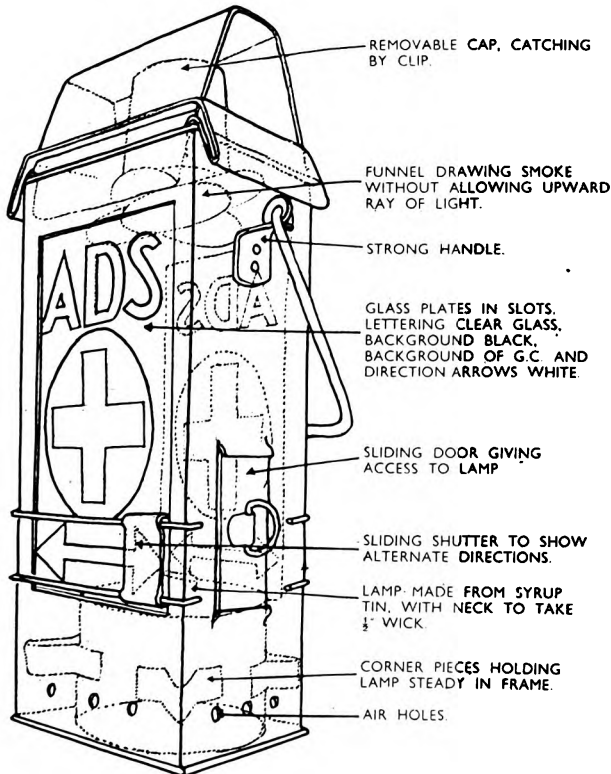
BY QUARTERMASTER-SERJEANT J. A. HOGARTH.

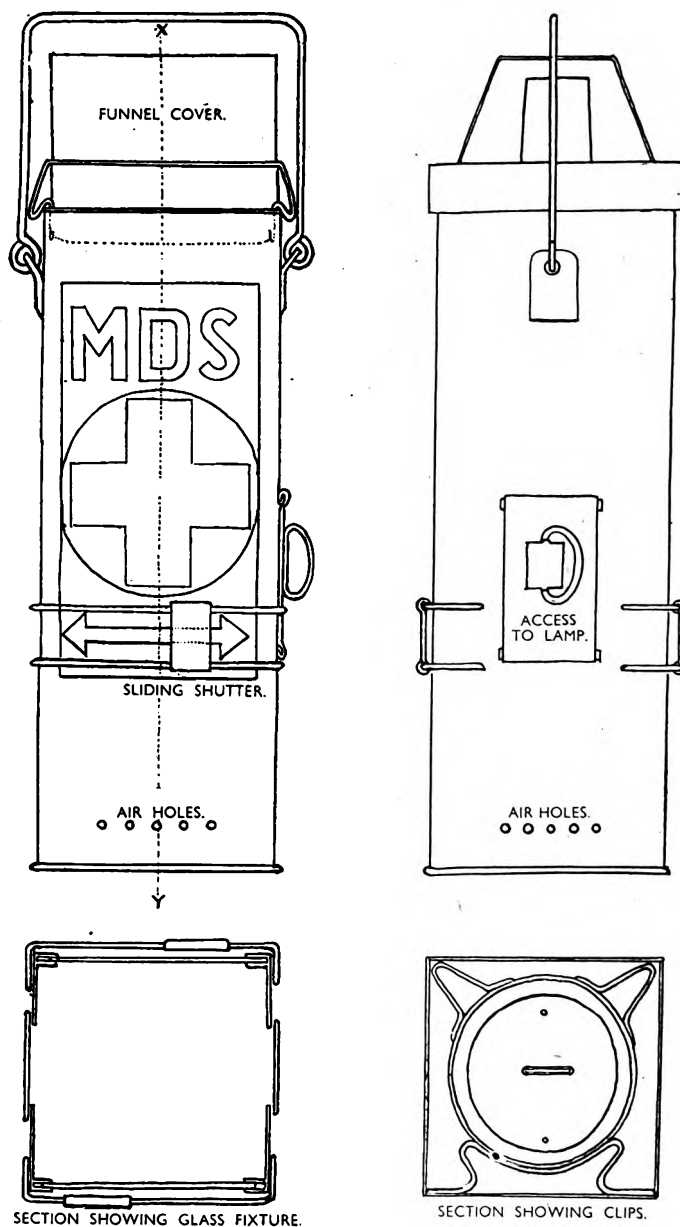
Royal Army Medical Corps.

As the number of hurricane lamps available in AF G 1098 equipment of a mechanized Field Ambulance was not sufficient to signpost all routes leading to Field Ambulance Dressing Stations and, further, that the four gallon petrol tin suitably adapted to cover the lamp was quickly damaged and became unfit for use, the urgent necessity for a stronger and less bulky lamp was apparent.

The minimum number of lamps required is 24 (i.e. 12 for H.Q. and 6 for each Coy.).

The following lamp has been improvised and made within the unit :





CONSTRUCTION.

The body and lid were made from beaten out, 4-gallon, non-returnable petrol tins, the wire guides for the sliding shutters from packing case wire and the carrying handles from fencing wire. The lamp was constructed by letting a wick holder of tin into the lid of a 2-pound syrup tin, care being taken to provide an air vent at the top of the lid.

The glasses for the two sides are $8\frac{1}{2}$ by $4\frac{1}{4}$ inches. They were coated with black enamel paint, then the letters (as required), the 4-inch diameter circle and the double-headed arrow, scraped off. These were then coated with white enamel and when dry the Red Cross was painted on the white circle. One head of the arrow may be covered at will by sliding the shutter.

OPERATION.

The lamp should be filled three-quarters full with paraffin and the wick adjusted so that it is just level with the top of the wick holder, NOT HIGHER. The lamp is then placed between the steadying clips and the lid placed on top. The shutter on the side of the lamp can be slid aside to allow the lamp to be lit. Adjusted as above, it should burn without attention for at least thirty-six hours and has proved wind proof.

I am indebted to Lieutenant-Colonel A. S. Pern, *T.D.*, R.A.M.C., for criticism and advice when making the lamp, and for permission to forward this description for publication.

EXTRACTS FROM LETTERS FROM A MOBILE SURGICAL UNIT.

8.12.41.

" . . . The work comes in spasms. Between the spasms there isn't much leisure as one has to get going making up expended supplies and seeing that things are straight again for another run of cases. Then moves are frequent and they take up quite a time. In the last month we have moved 12 times. And that is not counting the various journeys I have been on my own to get supplies, information, to spy out the lie of the land and so on. . . . Just now it is difficult to realize the magnitude of the world-wide convulsion being staged by the human race. Being mixed up in a campaign all on our own in this desolate place narrows the mental horizon; the more so since the horizon of the desert seems limitless. The untouched blankness of the desert is not so desolate as the field of battle when the fight has rolled on. The derelict vehicles, the scattered bits of ragged uniform, the shallow holes scratched in the stony ground for protection; all these serve to emphasize the intense loneliness of this place. Not that we are lonely. There are always many of us together and we are occupied and that is much. . . . We happen to be in a place where water is easier to get so I gave an order for a gallon per man to be issued to all members of the unit for washing purposes—the first decent wash any of us have had since leaving Cairo. Of course, until the first few days of November we were near the coast and able to bathe so it is little more than a month since we had a bath. You'd be surprised what a lot of water a gallon seems when you have managed with less than a mugful for a few weeks. At last Bob has rejoined us, just at the moment when it looks as if the work is going to slack off for a time. George is still away, but I gather he may be starting after us soon.

It may take him anything up to 10 days to find us. Still, Reg and I have managed pretty well on our own, sometimes borrowing an anæsthetist from another unit, sometimes giving our anæsthetics ourselves (intravenously). We have between us done 134 operations, mostly major, and many of them on very grave cases, with three deaths. I expect others will have died since, as even the gravest cases had to be evacuated within two or three days, but this is much better than we expected and we shall be content if we can keep up this average. . . . I have a few special rations put by for Christmas and a bottle or two of special elixir. I wonder where we shall be on that day? The one snag about advancing is the longer route for mail."

16.12.41.

" . . . For the moment we have fallen on a slack time. Still on the move though we have been at the present spot for three days now, almost a record. It isn't a bad spot as spots go. We are camped just below an escarpment about 50 feet high and quite steep. Unfortunately the slope is to the north so there is no shelter from the wind which whistles across the plain from the sea not many miles away. To-day, for the first time for a week or more, the sun is shining, the wind slight and I've been sitting with my shirt off. The only trouble is flies which are numerous, especially to-day, on account of the unaccustomed warmth. I think the reason that there are so many is that this is a vacated enemy position that has been occupied for many months by the looks of things. Lots of dugouts and stone huts built into the hillside, slit trenches and so on. Nearby is a supply dump. Most of the good stuff had gone by the time we arrived but there were at least 100 pairs of good boots and all the chaps have now one or two new pairs. They are quite good, being of fairly soft leather. I've got a pair myself which Fineberg has just collected for me. Being the local boss I did not deign to grub for loot myself but I'm not above wearing the boots.

Battlefields are sad and desolate places not because of corpses—corpses are rare, at all events by the time we arrive on the scene and rare anyway, for one sees but few graves though these are sad enough. Just a low long mound with rude wooden crosses and the name and number of the soldier written upon it; sometimes not that, perhaps just "Unknown German" or "Unknown Italian" or "Unknown Englishman." The thing that is saddest about a battlefield is the atmosphere of senseless waste of material and, even more, of courage and effort and human emotion. I have been busy when free at night writing a report on the cases we have dealt with so far. Hooper and I between us have done 134 operations of some magnitude. This is not nearly as much work as we hoped to have but, considering it represents only 9 full operating days averaging 15 cases a day, it is not too bad. The rest of the cases have been but minor stuff and dressings. We have picked up quite a bit of captured medical equipment, mainly dressings and such like. As I've said before the most of the good stuff has gone by the time we arrive on the scene. There is one drawback

to getting somewhere near habited parts again: the fleas. While we were well out in the open desert there weren't any. Now they are becoming troublesome again, and the tins of flea powder are once again in evidence. Pestiferous beasts. . . ."

18.12.41.

"So far I've written a longish report on the cases Reg and I have done since the battle started. Now I'll have to set to work and write something about the make-up and organization of a mobile surgical unit in the light of our experience. It has been very valuable in crystallizing one's ideas and giving the answer to several questions that couldn't be answered without practical experience. As usual, transport is the crux of the matter. Reliable transport and plenty of it is absolutely essential in this kind of warfare where long distances over rough and roadless country have to be made at short notice."

23.12.41.

" . . . By this we actually are on roads again from time to time. It is strange after two months of trackless sand and gravel. . . . As a matter of fact bits of the road are worse than no road at all, much worse, for there is a hell of a lot of traffic and no means of choosing one's own path to avoid it. The last few days we have been busy again. In fact, yesterday was our busiest day. We dealt with about 50 cases and about 30 of them had operations of some size. On the whole they were not a very serious bunch but some were very ill and a few required extensive operations. We worked a stretch of 16 hours, and polished them off in that time. Not bad going and I am really very pleased with the way the team got down to it and dealt with the situation. As you know, Bob and George have now joined us so they had their baptism of fire or rather blood. It is a great relief having a full team and, as you can see by the number of cases we got through in a relatively short time, the work is done much faster. Bob is an excellent anaesthetist; he gets on with the job and doesn't waste any time and he stands up to the work well. . . . It was rather an amusing night last night. As we had had a long session and the drivers, who had been acting as stretcher bearers, as well as the rest of us, had been working hard, I arranged for the cook to come along at the end, about 2 a.m. (we finished about 3 a.m.) to make a meal. He was just going nicely, stewing something on a primus stove, and we were finishing off the last few cases, when there was a burst of flame in the corner and the whole works looked as if it would go up in smoke. A primus stove had come to bits and burning paraffin shot all over the place. A prisoner of war, waiting his turn for operation, who had shown signs of passing out it seemed, suddenly leapt to his feet and ran for the exit. However the flames were soon under control and no harm was done. . . . Recently it has been much milder, partly because we

are near the sea and people of the hardier type have been bathing (not I). But to-night it is quite cool and I've just lit a primus stove to warm me up as I sit in the "theatre" typing (not the explosive type of primus). I wish you could see this theatre of ours, of mine I can say, since I thought of it and designed it roughly. It is a great squarish tent with rounded corners in front, square behind, built around the lorry, which occupies the front centre and acts as the central support. It is 30 by 40 feet. Over the lorry it is 10 feet high sloping gradually to the sides which are supported on poles 6 feet high, then sloping abruptly to the ground a couple of feet further out. It is made of green canvas which has been camouflaged first with paint and then by the natural accumulation of dust to tally exactly with the desert. It is nearly light-proof and with suitable shades quite light-proof. From the outside it looks rather like a giant mole hill with a flattish top and rather steep sides. . . . And now we have tents enough to take more than 40 patients; almost a hospital. And in all 15 men and 4 officers."

MODIFICATIONS OF ORR'S HUT.

BY LIEUTENANT-COLONEL L. R. H. KEATINGE,

Royal Army Medical Corps.

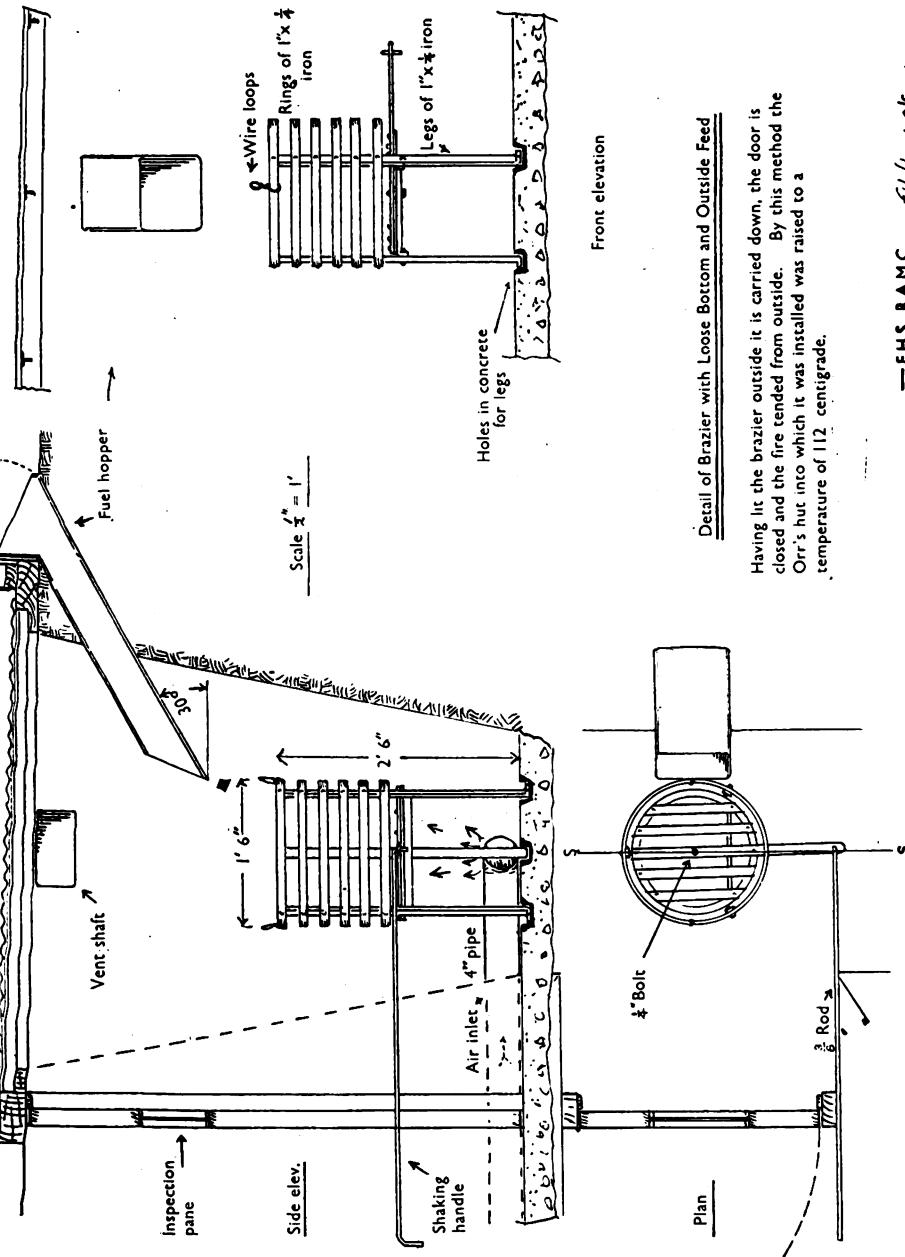
IN order to remove the possible dangers of carbon monoxide poisoning from the operation of the Orr's Hut type of Hot Air Disinfestor, certain modifications of the original pattern were worked out, and an experimental hut built. These modifications were first suggested in Douai, in order to provide a large static disinfestor for the Corps Reception Camp at Cantin, and were under construction when Henry the Hun so rudely interrupted the even tenor of our ways.

A Hut has now been built by No. — Field Hygiene Section and has been in use. The object desired is to remove all necessity for the orderly in charge to enter either the "brazier pit" or the "hot air chamber," during operations.

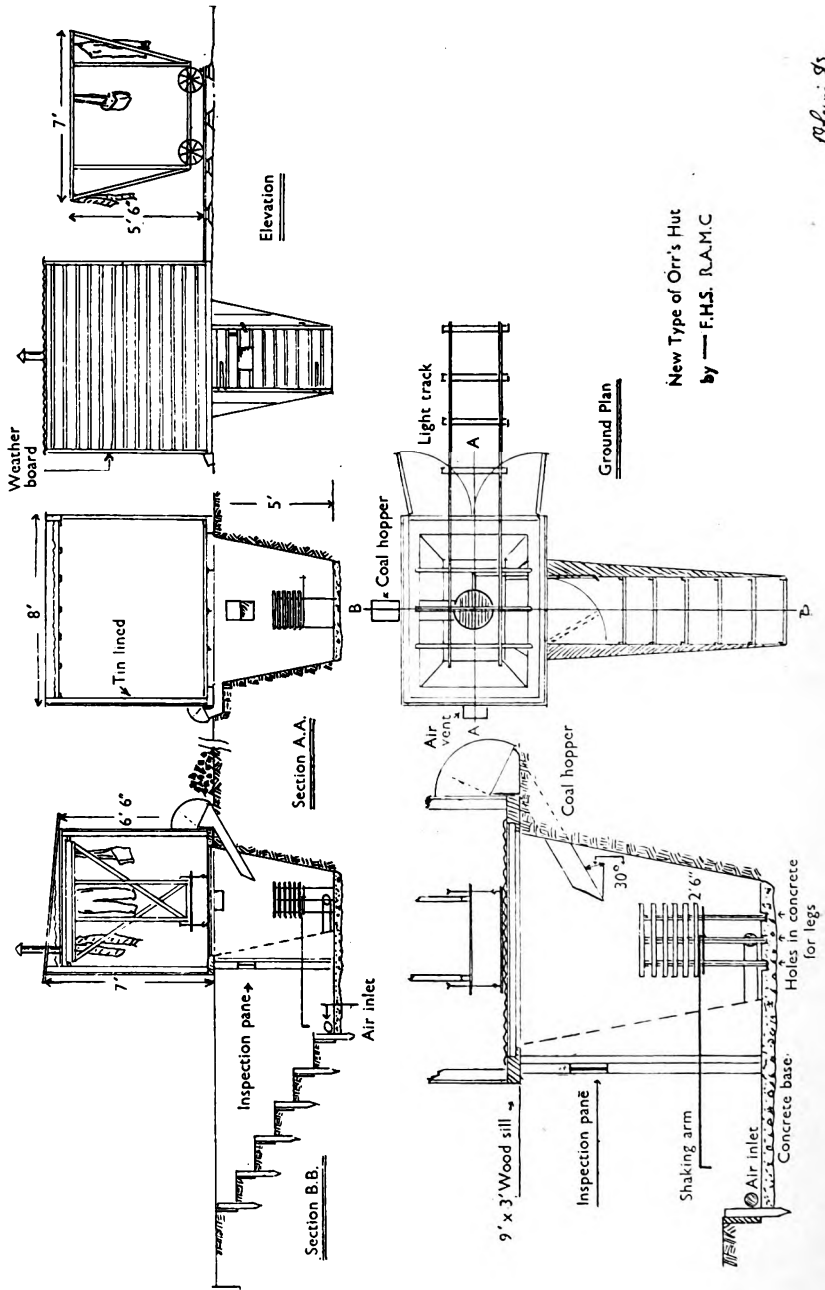
The actual building is of the original type as demonstrated in the "Army Manual of Hygiene and Sanitation, 1934," with the exceptions that (1) it is, for economy's sake, a "one brazier" hut, and (2) the metal lining is made of petrol tins because we could not get sufficient corrugated iron for walls as well as the floor.

When starting the day's work, the orderly goes into the brazier pit, and takes out the brazier. He lights it outside and, when it is well alight, he places it back in the pit with the legs set in slots in a concrete or other hard floor. He shuts the door of the "brazier pit." During the remainder of the working hours, he stokes the brazier through a coal shute, which has a lid to obviate loss of heat, and he rakes the fire by means of a shaking

handle which agitates the floor of the brazier. The door of the pit has a glass panel through which he can see what is going on.



The hot air chamber is loaded in the ordinary way, by a track and trolley. At the end of the day, the double doors of the hot air chamber are



New Type of Orr's Hut
by — F.H.S. R.A.M.C.

Revised 95
7.3.4

hooked open, the door of the brazier chamber is kept ajar, and the coal chute and ventilating shaft are opened. By the time the hut is required again, the fire is out and the chamber free of any offence.

A temperature of 112° C. has been reached. The fact that the door of the brazier pit is never opened assists in attaining and maintaining the temperature.

The construction of the hut and the plans were carried out by Staff Serjeant Lewis, R.A.M.C. of No. — Field Hygiene Section for whose help I am very grateful.

LOCAL ANÆSTHESIA FOR TONSILLECTOMY.

BY MAJOR C. A. MOULDEN,

Royal Army Medical Corps.

THE operation of dissection of the tonsils may be performed either under a general anæsthetic or with a local anæsthetic. If done under a local anæsthetic the performance of the operation is facilitated if the tonsil beds are properly infiltrated. Morey (1934) drew attention to this aspect in a paper in which he advocated the use of much greater quantities of infiltrating fluid than are usually employed. He suggested that the use of 15 c.c. or more of $\frac{1}{2}$ per cent novocain solution, with added adrenaline, for each tonsil, made for a much easier and more satisfactory dissection. In his description of the infiltration he describes the injection of the upper part of the tonsil at three sites, in front, behind and above. Colledge, in the *Encyclopedia of Medical Practice*, describes the injection of infiltrating fluid into five sites per tonsil, three above and two below; in this description there is no mention of the amount of fluid used.

A satisfactory tonsillectomy achieves the result of total removal of the tonsil with the minimum of pain and discomfort. In my experience I have found that this result, amongst men, is achieved more easily with a local than with a general anæsthetic.

Premedication is essential to allay anxiety and apprehension and to this end $\frac{1}{4}$ grain of morphia is given half an hour before operation.

There is a division of textbook opinion as to the position of the patient for operation. For convenience of the operator the sitting position is ideal but, as there is some liability for the patient to faint, the recumbent or semi-recumbent position is recommended by most authorities. The use of the cocaine spray is a factor in the production of this tendency to faint. I use the sitting posture and avoid the use of the cocaine spray as far as possible.

To simplify the maintenance of aseptic technique the patient dons a long sleeved gown, his hands remaining within the sleeves, and a sterile bowl is placed on his knees. The operation can be performed without the use of the bowl for ejected blood and saliva by the employment, instead,

of a sucker. By this means the operation can be carried through without a break but, having tried both methods, I find that the operation is less of an ordeal for the patient if he has short breaks for the ejection of saliva and blood.

An injection of $\frac{1}{2}$ c.c. 3 per cent novocain is made into the hard palate in the region of the posterior palatine foramina. This serves as a regional anæsthetic by blocking the descending branches from the sphenopalatine ganglion to the fauces and those branches which pass forwards to the gums.

The tonsil beds are infiltrated with $\frac{1}{2}$ per cent novocain with added adrenaline, a Labat's syringe and spinal needle being used for this purpose, a total of 44 c.c. being injected for each case. The upper pole of the tonsil is infiltrated by one injection of 11 c.c. which is injected into the soft palate at a point midway between the base of the uvula and the posterior margin of the palatal process. During the injection of this point localized blebbing must be avoided. If fluid is seen to escape from the intra-tonsillar recess the needle must be replaced more laterally. When this injection is being correctly made the upper part of the tonsil can be seen to be pushed down wards and the whole of the corresponding side of the soft palate is seen to bulge and resemble a peritonsillar abscess. The tonsil is injected again at its lower part with a similar quantity of fluid. The use of the tongue depressor is essential at this stage to display the lower pole and to put the anterior pillar on the stretch. The injection is made as low down as practicable, the fluid being injected into the mid-line of the tonsil bed. This injection, properly done, makes the tonsil move towards the mid-line. When both tonsils have been injected I have not found any advantage in waiting for any further infiltration to take place.

The operation itself is made much easier by this method of infiltration and needs no detailed description. The use of the snare is not accompanied by any pain.

Bleeding is slight. It is rare to have to tie off a vessel and this is done without discomfort. The application of a tannic acid jelly to the tonsil beds on a pad of gauze is a useful routine in that it arrests capillary hæmorrhage quickly and lessens the tendency to post-operative hæmorrhage.

I am indebted to Lieutenant-Colonel T. L. Henderson, R.A.M.C., Officer Commanding the Surgical Division, for his co-operation and help and to Colonel J. W. F. Sandison, O.B.E., M.C., for his permission to forward this paper for publication.

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Current Literature.

GREEN, H. N. **Laboratory Infection with *Brucella abortus*.** *Brit. M. J.* 1941, Mar. 29, 478-9.

The author records three cases of laboratory infection with *Br. abortus* which had been subcultured for nearly three years after isolation from a human case of the disease. The usual precautions were taken to obviate accidental infection, and in the case of the first patient the only direct exposure was in counting colonies on open agar plates or in preparing and diluting emulsions from slopes. The disease ran a severe course of three months' duration.

Thereafter more stringent precautions were taken, benches were sterilized after contact with glassware containing cultures, hands and arms carefully washed, gloves worn, etc. Nevertheless, eleven months after the first case, a laboratory assistant was attacked. Among his duties was the periodic preparation of culture washings from Roux bottles, the washings being poured slowly through a glass funnel into an Erlenmeyer flask. The course of disease was long—three months—but less severe than in the first.

One month after the onset of the second case, another laboratory assistant was attacked. He had helped the other, but had had no known contact with the cultures for a month, as work with it was suspended when the second was attacked. The course in this patient was prolonged, the fever subsiding in four months, and fairly severe.

If there was not infection by a skin abrasion or contaminated fingers, and none such was known, a possibility—not proved—of air-borne infection from a dried culture must be considered. It is suggested that, as in the cases of the two latter patients the strain was one which was sulphanilamide resistant, exposure to the drug may have increased its virulence or invasive properties, a purely hypothetical point at present. H. H. S.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 6.

NATURE, 1941, Feb. 1, 132-4. **The Carrot as Food.**

This is a brief and timely survey of the food value of the carrot. The roots contain 10 to 15 per cent of solid matter much of which is sugar. The green tops are rich in vitamin C and could be used in place of parsley in sauces. The chief value, however, of the carrot is its high content of carotene, the precursor of vitamin A. Many root vegetables such as parsnip, turnip, swede, radish and potato are negligible sources of carotene. When the amount of carotene and vitamin A ingested is more than adequate, stores of the vitamin are laid down, mainly in the liver. In the adult man, these stores may rise to about a three months' supply. When the diet is low in carotene and vitamin A, the reserves are used up, night blindness being an early effect of deficiency. Effects such as xerophthalmia and

severe skin abnormalities occur only after prolonged deficiency so that the infrequency of visible lesions can by no means be taken as an indication of a universally adequate vitamin A intake. The association of vitamin A with resistance to infection still presents difficulties, but it is clear that under experimental conditions deficiency in vitamin A leads to reduced resistance of the mucous membrane to bacterial invasion. It is estimated that the daily requirement of vitamin A is 2,500 I.U. or of carotene 5,000 I.U. in oily solution (1 I.U.=0.6 microgram of β -carotene). It has been found that even when carotene is given in its most easily assimilable form as an oily solution, only about half is utilized to form vitamin A. It is also calculated that only 20 per cent of the carotene ingested as raw or cooked carrot is absorbed by the intestines. Mature carrots contain about 200 I.U. per gram, a much higher value than for cabbage which contains about 10 I.U. per gram. About 50 grams (or 2 ounces) of carrot would therefore be necessary to make up the full daily requirement. In practice, however, the vitamin A requirement is not supplied only by carrots, but also by milk, butter, eggs, liver, green vegetables and yellow fruits such as the apricot. The daily intake of vitamin A is assessed roughly at about 1,000 I.U. from milk and vitaminized margarine leaving the rest to come from vegetables. To calculate the national requirement of carrots, it is assumed that the carrot during the course of the year will provide about half the carotene necessary in the diet, which means an average consumption of 1 ounce per head of the population per day, equivalent to 400,000 tons annually for the whole population. Carrots can be stored without loss of carotene. Canning also has no effect on the carotene content of carrots, but mature rather than young carrots should be canned since the carotene content of the latter is often less than half that of the mature root. The drying of carrots is suggested, also the preparation of carrot meal which is sweet and could be used for cakes and biscuits. The inclusion of carrot in marmalade is also a possibility. The immediate increased consumption of carrots would represent a real national asset in that the increased storage of vitamin A in the liver would help to counteract a future shortage and would no doubt result immediately in a general improvement in dark adaptation with a corresponding decrease in black-out accidents. DOUGLAS C. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 6.

Notice.

THE HEBERDEN MEDAL.

THE Heberden Society has decided to make a special award of the Heberden Medal, with an honorarium of twenty guineas, for original work on the problem of low back pain, with or without sciatic neuralgia, which in their opinion represents an advance in treatment likely to lead to a reduction in the present average period of disability. These should be submitted to the Secretary of the Society, c/o the B.R.C.S. Clinic for Rheumatism, Peto Place, London, N.W.1, before December 25, 1942.

Authors are alone responsible for the statements
made and the opinions expressed in their papers.

Journal
of the
Royal Army Medical Corps.

Original Communications.

CERTAIN PROPERTIES OF PLASMA WITH A NEW METHOD
FOR LARGE SCALE PRODUCTION OF A NON-CLOTTING
PRODUCT.

BY QUARTERMASTER-SERGEANT S. R. M. BUSHBY

AND

BRIGADIER L. E. H. WHITBY, C.V.O., M.C., M.D., F.R.C.P.

Army Blood Transfusion Service.

CITRATED plasma is now acknowledged as a safe and efficient protein-containing fluid for blood volume restoration; it is widely used as a blood substitute both in fluid and dried form. But it is an excellent culture medium and can only be rendered safe for use by efficient bacterial filtration. The addition of restraining antiseptics has so many potential disadvantages and has been found to afford so little protection that it is no longer practised. Filtration not only ensures sterility but also renders the plasma clear and thus affords a practical means of checking its fitness for use. Safe filtered plasma is always clear; turbid filtered plasma may be contaminated and should be discarded. Unfiltered plasma is always turbid and cannot be assumed to be sterile unless a sample be cultured, an act which itself gives opportunity for contamination. Seitz asbestos pad filtration offers the only practical method but unfortunately large scale work is associated with post-filtration clotting; this may vary from massive clots soon after filtration to fine clumps of fibrin many weeks later. Provided the plasma is clear, clot formation does not prohibit use but may cause mechanical difficulties during administration and fine aggregates may make the fluid appear turbid when the bottle is inverted. Post-filtration clotting has previously been

shown (Bushby and Whitby 1941) to be caused by thrombin. Magnesium silicate, the principal ingredient of the asbestos from which the pads are prepared, has the property of absorbing a certain amount of prothrombin. The first portions of plasma which pass through an asbestos filter are therefore devoid of this proenzyme but that which is absorbed on the pad slowly becomes activated to thrombin.

The method devised to eliminate this difficulty (Bushby and Whitby 1941) made use of the fact that prothrombin is soluble in weak alkali. By washing the filter pads with N/30 NaOH the prothrombin on the pad is removed before it can be activated.

The method has not been entirely satisfactory; a trace of thrombin is usually formed and this converts small amounts of fibrinogen to fibrin. The formation of visible clots is often delayed because the conversion of fibrinogen to insoluble fibrin is a quantitative process depending upon the concentration of the reagents—fibrinogen and thrombin—as well as upon physical conditions. The change from fibrinogen to fibrin takes place in two stages; the first, a chemical one, in which soluble fibrinogen is converted into soluble fibrin and the second, a physical one, in which soluble fibrin is changed to the insoluble form (Mellanby 1933). The chemical change comes about during filtration by reason of the thrombin formed on the asbestos filter pad. The physical change may be regarded as a process due to aggregation of the molecules. As such it will depend mainly upon the concentration of the fibrin molecules. When the concentration is low several weeks may elapse before visible fibrin is formed; when the concentration is high massive clots appear rapidly. Furthermore the aggregation of low concentrations is accelerated by shaking and also by freezing which has the effect of concentrating molecules in solution. This is the explanation of the delayed clot formation in plasma produced by the alkaline wash process especially when the plasma is refrigerated.

The principle of the present method is to make use of the stability of prothrombin in alkali so that filtration is carried out in the stable phase. In these circumstances no thrombin can be formed and the filtrate is therefore free from the substance that gives rise to post-filtration clotting. Prothrombin is at first retained on the filter pad but is incapable of being activated; it later appears in the filtrate. After filtration the alkalinity is readjusted to pH 7 with CO_2 .

Method.—The addition of 45 c.c. N. NaOH to 1 litre of citrate plasma (100 c.c. 3 per cent sodium citrate to 440 c.c. blood) achieves a pH of approximately 10.6. At this pH if plasma be filtered within an hour or two no post-filtration clotting occurs. Moreover, if the plasma be received into a Winchester quart bottle containing CO_2 at 3 lb. pressure, the bottle being agitated during the time of reception, the reaction becomes quickly adjusted to pH 7.

Alkalinization of Plasma (fig. 1).—The plasma to be alkalinized is contained in bottle A. The suspended transfusion bottle B contains an amount

of N. NaOH sufficient to contribute 45 c.c. to every litre of plasma in bottle A. Suction from a pump, applied through wash bottle C, has the effect of sucking into bottle D the plasma from bottle A and the NaOH from bottle B. Mixture of the two fluids actually occurs at the point X. The inclusion of two control clips Y and Z and the drip counter E enables the speed of flow of the NaOH to be adjusted so that bottle B is emptied at the same relative rate as bottle A. This ensures continuous mixing in

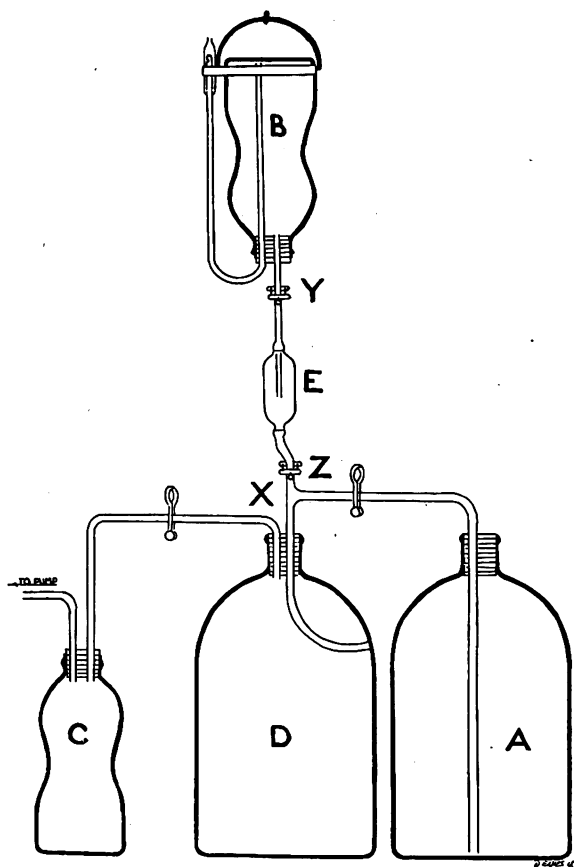


FIG. 1.—Alkalinization of Plasma.

the right amount without there being any chance of even a momentary excessive concentration of NaOH.

Filtration and Bottling (fig. 2).—The whole apparatus, with the exception of the CO₂ cylinder and Winchester A containing unfiltered plasma, is autoclaved as a complete unit with all clips open; the bottling hood is plugged with a large cotton wool pad held in place with gauze. The plasma, alkalinized as shown in fig. 1, is contained in the Winchester A. The two Winchesters, B and C, are first filled with physiological saline, passed through

the filter with clips K, H, J and L closed. Close clips F and G and open H and J; using 3 lb. pressure CO_2 from container D displace the saline with the gas allowing the fluid to run to waste by releasing clip K. This leaves Winchester B and C filled with CO_2 at 3 lb. pressure. Screw clip F is then opened; all clips other than E are closed. Using 10 lb. pressure of air force the unfiltered plasma from Winchester A through the filter and receive it in Winchester B which must be shaken during reception. When Winchester B is three-quarters full, close clip F and open clip J whereupon the neutralized plasma is forced by the 3 lb. pressure of CO_2 onwards to the bottling hood controlled by clip K. Winchester B when emptied of plasma is therefore filled with CO_2 ready to receive the next filtered batch. At the same time if clip G be opened filtered plasma passes into Winchester C and this in turn, having been well shaken, is ready for bottling by merely closing clip G and

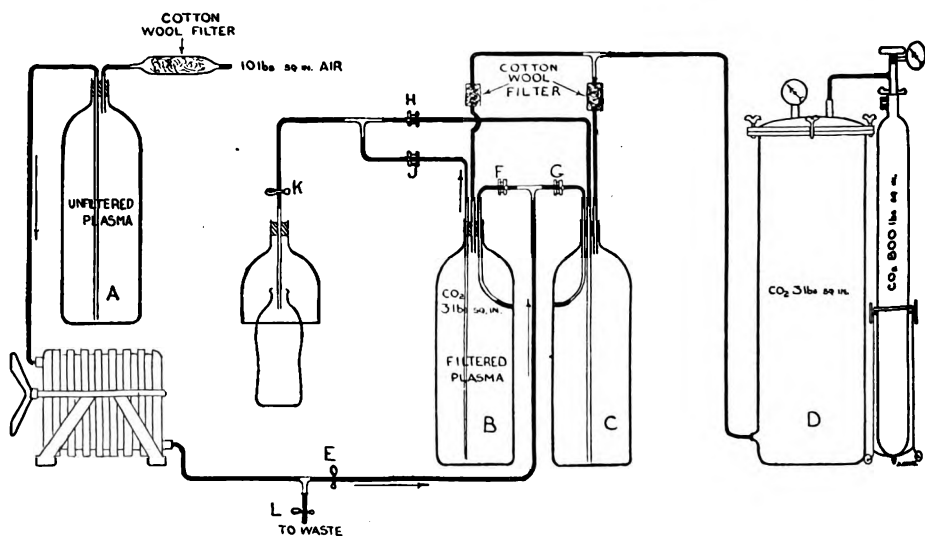


FIG. 2.—Filtration and bottling.

opening clip H. The process can thus be repeated as a continuous cycle filling bottles B and C alternately and distributing via the bottling hood by opening and closing the appropriate clips. Winchester A is changed for a full one as and when required. Filtration up to any amount can be carried out without changing the pads but personal experience has fixed the limit at 80 litres in that a single defective pad will ruin a whole batch. The pads tend to collect a certain amount of fat except from especially clarified plasma and it is advisable to wash the filter through with 2 litres N/30 NaOH after filtering each batch of 20 litres; this is done by closing clip E and opening clip L; the NaOH is removed from the pads by washing with 4 litres 0.85 per cent NaCl. When plasma is especially by prefiltration through asbestos pads (for which purpose the filter need not be sterilized) then the pad-washing process can be omitted.

Tests for denaturation, toxicity and efficiency of this type of plasma.—

The plasma so produced has been fully tested during many months. No more than a summary of the results can be given here. Alkalinization to pH 9.5 for periods as long as six months does not render plasma toxic to animals or human subjects. Indeed, large amounts of such alkaline (unneutralized) plasma have been administered to air raid casualties without immediate reaction or remote effect and with efficient results. Plasma brought to pH of approximately 10.6 by the addition of 45 c.c. N. NaOH per litre does not show evidence of denaturation when examined five days later by the sodium nitro prusside test. It is therefore clear that alkalinization to pH 10.6 for an hour or two has no denaturing effect. Plasma alkalinized to pH 10.6, filtered and afterwards adjusted to pH 7 with CO₂ as described above, has been extensively tested on animals and human subjects with very satisfactory results; it can be clotted in a normal manner by the addition of calcium and thrombokinase (lung extract) which implies no denaturation even of prothrombin; nor does it show any evidence of denaturation or alteration of any part of the protein content in that patients who have been transfused with it have, after an interval of three weeks, been tested for dermal sensitivity, followed by a test for general sensitivity to the intravenous injection of 20 c.c. In no case has there been either dermal or pyrexial reaction. From this it is concluded that the transfused protein was in its natural state. Certain other general points are of importance. This non-clotting plasma has been kept for four months under alternating adverse conditions of storage (refrigeration—warming) and has been shaken about in transport without any sign of clot formation (large or fine) and with no deposition. The plasma appears clear when viewed with transmitted light but is slightly opalescent (not turbid) with reflected light; this seems to be due to prothrombin itself. The yield of plasma by this method is approximately 20 per cent more than by the older method with which a great deal was lost during the numerous pad washing processes. The saving in time is very great. The method is readily adapted to filters of 14 c.c. size and if CO₂ is not available neutralization can be effected with citric acid provided it is arranged for mixing of the concentrated acid with the alkaline plasma to occur evenly in a manner similar in principle to that shown in fig. 1.

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IMPROVEMENTS IN THE OIL AND WATER FLASH FIRE.

BY MAJOR FRÉDÉRIC EVANS, *M.B.E.*,*Royal Army Medical Corps.*

THE "oil and water flash fire" is in the Army a well-known device for utilizing waste sump oil to provide a heating unit suitable, in particular, for cooking purposes. In its simplest form it consists of oil and water containers which drip oil and water respectively into an angle iron which delivers the flow on to a hot plate made of an old "dixie" lid or other iron tray.

This hot plate is preheated by burning upon it an oily rag, dry sticks or similar easily combustible material and, when it is hot enough to "flash" the oil, this oil is run on with drops of water, supported by the surface tension, upon it.

When this mixture falls on to the hot plate, the water bursts violently into steam and, in so doing, atomizes the oil thoroughly. The hot plate causes this atomized oil to combust freely above it and so a brisk crackling fire is obtained and also maintained.

In this simple form several disadvantages of working usually appear. Often the oil itself already contains a high proportion of water and the balance of combustible oil and atomizing water is upset. Then on a plain plate there may be an insufficient supply of air at the right place to support complete combustion of the oil. The result may be an inconsistent, smoky and dirty fire. Taps or drippers may become choked with solid impurities in the oil and the arrangements may therefore call for much more attention than should be necessary. Sometimes the fire on the hot plate gets blown out by a sudden gust of wind.

Much work has recently been carried out at the Army School of Hygiene in overcoming some of these disadvantages and in making the oil and water flash fire an economical and practical heating method for a variety of purposes. This article is intended to describe the conclusions so far reached. They are of obvious interest in the circumstances of modern warfare wherein vast fleets of motorized fighting and supply vehicles are essential to success and when much of the fighting is being done in arid and treeless regions where other fuel is almost unobtainable. Waste sump oil is hardly worth taking back great distances to the rear when it is required and can be used as a fuel by the units at the front. Improvements in the method of its use as a fuel may therefore be well worth describing in some detail. It is not intended to discuss here the simplest improvisations of the "oil and water flash fire" but improvements which are well within the resources of units carrying the simpler tools and able to obtain, from one source or another, the odd pieces of material which are required are worth recording.

First let us consider the oil fuel. This is usually either saved when crank cases of motorized vehicles are emptied or is obtained from the Army Salvage Depots. Such oil supplies may contain solid impurities and a high proportion of water therefore the oil must be strained through gauze, muslin, sack-ing or finely perforated zinc or tin. Thus the grosser solid particles are removed.

Then it should be stood, for about half an hour at least, in a drum with a tap or plug at the bottom through which the heavier water can be drawn when it has settled to the bottom of the drum.

In drawing off the separated water, when oil begins to appear from the tap it will be well to run off the first part of this flow into a small can before it can be assumed that oil reasonably free from water is running. This can of mixed oil and water can be returned into the separator drum for the next separation period. Thus no oil is wasted.

The oil and water separator combined with a strainer for solid particles and also oil and water dripping taps can be used also to supply the fire. In this assembly, the water tap should be at the bottom and the oil tap about a quarter of the distance from the bottom of the drum. Then the actual water separated from the oil is dripped *in the right proportion* upon the oil flow. If the oil is free from water, or contains very little, about a third of the oil quantity can be added of water so that the water level is kept below the upper or oil tap. While the lower tap delivers water, no further water need be added.

This brings us to methods of feeding the oil and water to the burning or flash plate. The simplest is by taps or plugged drip holes from two open containers or tanks. This method has the disadvantage of varying pressures upon the vents resulting from a fall in the hydraulic head of the water and oil as the levels are lowered through the liquids draining away. Thus the taps or plugs frequently have to be adjusted to produce a regular rate of flow for water and oil. Such "feeds" cannot be left long without attention.

Fig. 1 shows a simple method of overcoming this objection. It utilizes the principle long used in the construction of drinking fountains for poultry. While there is oil or water in the can or drum up to the level of the top of the horizontal tube a constant head is maintained in the dripping tins and, once adjusted, the trickle of oil or water is even. The contrivance is made by soldering a slightly tapered tin tube into the bottom of a small tin which acts as the drip tin, this tube being plugged into the bung hole of an unaltered petrol can or oil drum. A paper or rubber gasket around this tin tube will make it liquid-tight and air-tight.

The oil and water drips are regulated by fitting circular, finely-tapered wood plugs through small holes at the edge of the bottom of the drip tins. The plug is held in position by a rubber band which goes round the top of the drip tin and, on the side where the plug is fixed, the rubber band is looped through two slots cut in the edge of the tin so as to encircle the wood plug. Two such containers will be required, one for oil and one for water.

A screen of corrugated iron or other material may be necessary with the "chicken feed" method to protect the containers, particularly the one holding water, from the heat of the fire. This may affect the area of low air pressure inside the container, expanding the air therein and upsetting the balance of the liquid in the drip tins, making them sometimes to overflow.

The usual channel by which the oil and, upon it, the water, are carried down to the flash plate is made of angle iron. This has some disadvantages. When the oil supply is low, the angle iron becomes itself hot enough to flash the oil and the fire then tends to burn within the angle iron and to creep up towards the drip taps.

To obviate this an iron pipe ($\frac{3}{4}$ or 1 in.) can be adapted as a feed pipe. Two slots about 2 in. long are cut, at the distances suitable for the dripping

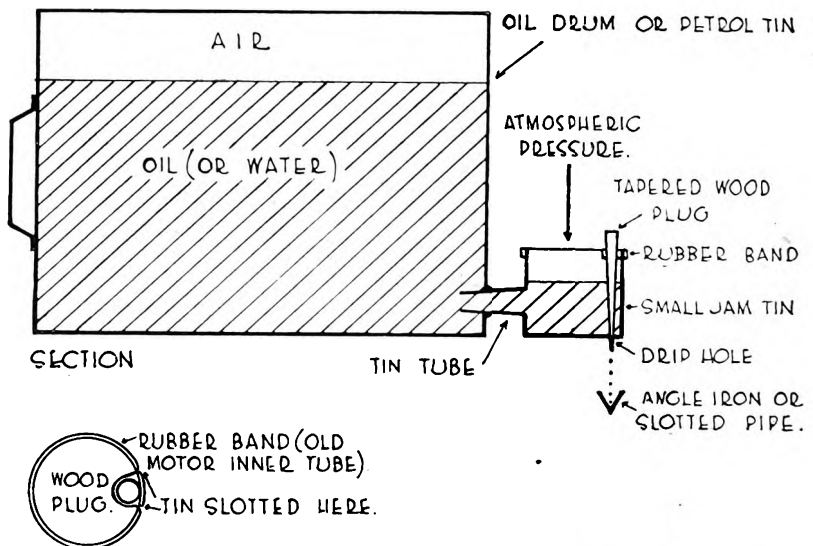


FIG. 1.—Oil or Water Dripper made from oil drum and jam tin.

taps above, in the upper half of the pipe and at the raised end. The lower end of the pipe is then flattened into a duck-bill shape and slightly overcut at this lower lip. This allows the oil and water to come through, well spread over the flash plate, and the orifice is at the same time kept small enough to prevent the fire from creeping up inside the pipe which, even if it gets hot enough at the lower end to flash the oil, will not have enough air supply within to burn it. Or, on the other hand, the end of the oil pipe can be kept cool by a wrapping of gauze or thin wire. The end of the oil pipe or angle iron should be suspended from four to eight inches away from the plate to cause a splashing of the oil as it falls and assist in its atomization. The pipe should not slope more than about 30° from the horizontal or the water may run into large blobs and be unevenly distributed on the oil.

One very simple system of oil feed has been described by Major G. J. Summers, R.A.M.C.¹ In this, one open container is used for both oil and water in the proportion of about 3 to 1. The mixture is kept stirred to form an emulsion and is dripped off from the container on to the angle iron or into the slotted pipe, about a quarter of the distance from the bottom of the container to the top, thus ensuring that the heavier water collecting in the lower portion of the container is not drawn upon and so upsetting the balance of oil and water reaching the flash plate. This system works quite well with supervision but is not so certain and uniform in its action as when oil and water are separately dripped into the angle iron or pipe. Experiments are being carried out in running the oil and water on to the flash plate in separate pipes and these are giving promising results.

But the most remarkable improvements are those that can be effected in the design of the burner or flash plate itself. Fig. 2 shows a satisfactory burner wherein arrangements have been made to supply the flame with extra air and also to provide for the burning of overflowed oil as well as for heating from its underside the top or flash plate more easily. One of these ventilated oil and water flash burners can easily be made from an old tray and two ends of a five gallon oil drum. The top or flash plate is cut slightly smaller in diameter and the edges then snicked and turned up to form a $\frac{3}{4}$ inch edge all round. The natural dishing in the middle is knocked up to form a low cone with a *shallow* hollow all around. The surround is perforated upwards with a sharp nail. The upward perforations cause upstanding burrs which tend to keep the hot oil on the top plate as it burns. The perforations provide an upward supply of air to assist the combustion. Halfway around the edge of this plate, on the side from which the air supply is coming, should be fixed a wind shield about $2\frac{1}{2}$ inches high. This can be of thin sheet iron riveted on or left on when the oil drum bottom is being cut out.²

The secondary burning plate is fixed 3 inches below the top one and held to it by a distance piece of $\frac{1}{2}$ inch piping fitted around a bolt 3 inches long. The convex side of the oil drum end is placed upwards in this case and the perforations are grouped in the convex central portion. The natural edge of the oil drum end is left in this instance to act as a containing weir for any oil which may drop through from the top plate. This then burns in the wide concave ring around the plate and it receives an additional supply of air from the perforations in the middle. Three legs, about 3 inches long, made of bolts, with distance pieces of $\frac{1}{2}$ inch pipe, raise the secondary burning plate above the tray upon which the burner is set. A single plate burner of this type on a tray will also work quite well.

It can be seen that, if oily rags or other readily combustible materials are burned between the top and secondary plates, the flash plate will be quickly dried and heated so as to flash the oil.

¹ *Journal of the Royal Army Medical Corps*, September, 1941.

² This improvement was suggested by Private A. A. Taylor, R.A.M.C., of the Workshop Staff, Army School of Hygiene.

A variant of this ventilated burner can be constructed with one plate made as described for the Top or Flash Plate in fig. 2, but in full size of an oil drum end, this being fitted across the diameter of an oil drum with its ends knocked out and perhaps a piece at the top (when the oil drum lies on its side) cut out. Such a plate can also be fitted on the bars of a fireplace with a tray beneath it to catch any overflowing oil.

A very important factor for success is in the protection of the fire, when burning, from the wind and at the same time providing generally for the right supply of air to the flames. Experiments showed that the fire worked best in an enclosed space such as a cooking trench or a horizontal oil drum flue, with a chimney at the other end, when the air was admitted through a narrow orifice to the top of the fire. If air was admitted below the burner the fire tended to spread and not to "draw." Sometimes, too, the full force of the air current cooled the flash plate enough to put the fire out. A narrow slot at the top of the opening is better than a square panel cut out of the cover plate. This cover plate should be movable to allow access to the

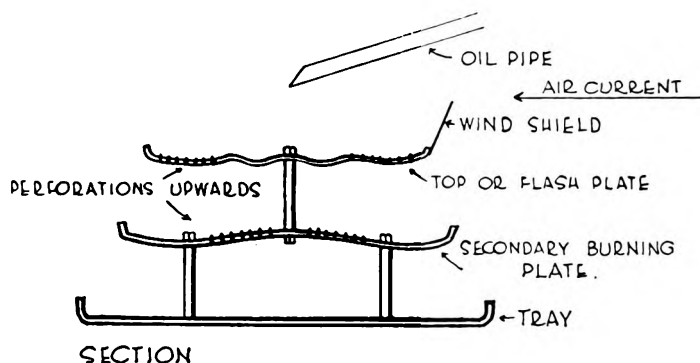


FIG. 2.—Ventilated Oil and Water Flash Burner.

burner for heating the flash plate and starting the fire. A damper in the chimney can be used to conserve heat and control the draught which should be gentle rather than fierce.

It now remains necessary only to recapitulate the main points; to remember when seeking success in the application of the oil and water flash fire to any purpose in the field where heat is required and when the apparatus has been constructed in accordance with the suggestions made in this article:—

(i) Heat the flash plate *thoroughly*, preferably from below. Use highly combustible material such as a paraffin or oil soaked rag which however must not be wet.

(ii) When the plate is very hot and dry, and not before, run a little oil down the pipe adding to it a trace of water as it passes down. Note that the oil is run in at the top end of the pipe and the water lower down.

(iii) If the oil does not flash at once, stop the oil and water and start again to dry and heat the plate.

(iv) When flashing occurs and everything is heated thoroughly, increase the oil and water flow gradually until about one-third to one-half the quantity of water to oil is being used. Do this slowly. Aim for a proper balance of oil, water and air. These in correct proportions will make the fire give off only a bluish smoke and the fire will be composed of light coloured dancing flames. Black smoke means too much oil, too little water or an insufficient air supply. The oil and water drips are best visible in order to facilitate correct adjustment.

(v) Protect the flash or burner plate from direct and heavy cold air currents. These cool the plate too much and it may thus fall in temperature below the oil flash point. A flash plate, not too thick to heat up quickly and not too thin to lose its heat readily, is best. Mild steel of about $\frac{1}{8}$ inch to $\frac{1}{2}$ inch gauge is about right.

(vi) If the old sump oil is of the vegetable or castrol type it will not flash so readily. This kind of oil can be mixed with mineral oil or a little paraffin to lower the flash point.

(vii) When the fire is burning well, remove from the flash plates the remnants of burning rag or other material used to start the fire. Keep the aerating holes in the plates large and clear. The overflow of oil which might occur will burn on the secondary plate and, if it has reached there, on the tray below. A scrubbing action over the flash plate with the end of a long stick will spread the oil and encourage the fire when once flashing is taking place.

(viii) It is an advantage in certain constructions to pack bricks loosely along the floor and sides of the fire chamber and the horizontal part of the flue. These bricks take up heat and retain it for a long time. A hot fire chamber and flue add to the efficiency of the fire and permit a higher proportion of water to oil to be used.

(ix) See that the oil is carefully cleared of solid impurities and separated from all possible water content. This action will tend to standardize the character of the fuel and to secure more predictable and regular results. This point is of special importance if success is to be obtained in the use of the oil and water flash fire.

(x) Arrange that the main air supply is admitted through a narrow slot well above the level of the top of the burner. Cut this slot down to a minimum in order to obtain a steady fire well protected from heavy inrushes of air. An overlapped or baffled inlet will often be found more satisfactory.

(xi) In enclosed spaces, the fire can be cut down to use a minimum amount of oil and a maximum amount of water. These fires can be left unattended for a couple of hours so long as enough oil and water are available in the containers. Such a fire, as described, has been found capable in a specially designed excreta incinerator of reducing to a few ounces of ash 25 pounds excreta and 12 pounds of contained urine with the consump-

tion of one gallon of oil, the time taken being one hour for this amount. A 5-gallon oil drum was found to be big enough to contain the oil for one average working day when this closed incinerator was used.

The applications of this fascinating method of firing and heating are legion. It can and has been used in excreta incinerators—also for heating water in the same installations. It is extensively used to boil water and raise steam in improvised disinfectors. It has been tried to provide the heating unit for standard disinfectors used in the field. The oil and water flash fire, properly designed, can be utilized as the heating unit for drying rooms, for improvised disinfectors using dry heat and for cooking and baking. It can be adapted for use in soyer stoves, in standard cooking apparatus and in slow combustion heating stoves. It is not my purpose in this article to discuss these applications in detail but perhaps I have said enough to encourage ingenuity in others when faced with the necessity of using waste oil as fuel in the campaign.

ACKNOWLEDGMENT.

This is gratefully made to Colonel E. Bruce Allnutt, *M.C.*, Commandant, Army School of Hygiene, for permission to conduct the experiments and to forward these notes for publication. The drawings were made by the draughtsmen of the Army School of Hygiene and the various pieces of apparatus constructed in the school workshops.

INVITATION TO ADVENTURE; AN ADDRESS TO THOSE ABOUT TO GRADUATE IN MEDICINE, 1941.

BY COLONEL F. A. E. CREW, M.D., F.R.S.

Late Royal Army Medical Corps.

You will, very shortly now, be graduating in Medicine and many of you will be joining the medical services of the armed forces of the Crown for the duration of hostilities. It is for me, a graduate in medicine of this University, a member of its medical faculty and now serving in the R.A.M.C. as a Territorial Officer, to present myself to you as an example and to offer, for your consideration, certain reflections which I have distilled from the experience that I have endured.

I do not enjoy the offering of advice to men so much younger than myself and the notion that I might be regarded as an example on which such might model themselves appals me. The reason for this is, perhaps, that I have listened to so many promoters at the graduation ceremony. In a week or two you will be presented to the Vice-Chancellor for capping. This being done, the promoter will address you and, unless he differs from all his predecessors, he will first congratulate you on your so recent emergence from academic immaturity and comment upon your remarkable and painful metamorphosis into adult professional life. Thereafter, he will proceed to anoint you lavishly with the fragrant unguents of his own personal and peculiar philosophy and as you listen, you will, if I mistake not, find yourselves puzzled, wondering which would, in fact, prove to be the more profitable—to follow his advice or to imitate his example, for seldom do the two seem to be in harmony. At least it can be said of me on this occasion that my example and my advice must of necessity be in agreement.

Soon you will find, to your everlasting astonishment, that quite suddenly you, who were, for almost as long as you can remember, carefree and irresponsible pupils, permitted and encouraged to devote yourselves to the fascinating discovery of such talents as lay hidden within you, to pursue your own personal education, to stand somewhat aloof from the mass of society that toiled and sweated in dull and unexciting trades, have become transformed, as though by some magical process, into highly privileged people heavily loaded with social responsibilities. You will then know that the effect of thyroid upon the axolotl and the differences between the axolotl and amblystoma are but slight when compared with the effects of graduation upon the medical student.

You will find that in you, individually and collectively, the general public will place great confidence and that what you do and say will be imitated and echoed; you will play a most important role in the shaping of public opinion and to you men will turn, hopefully, for the solution of all kinds

of personal and public problems. Whether you wish it or not, whether you are worthy of it or not, the mantle of leadership will be flung around your shoulders. Soon you will know that to practise medicine is not only a grand adventure in experimental human and social biology but also a great privilege. Through it you may gain virtue and achieve intellectual and spiritual grandeur, for there is no field of human activity in which a man may give greater service to the community, no labour from which greater tranquillity of mind can be derived, no work that can bring greater reward in the currency of self-respect. You are about to join the goodly fellowship of the architects and the builders of the future and you will find that the true patients of the physician are the generations as yet unborn.

Privilege has but one interpretation—responsibility. May I be permitted to remind you that behind the fact that you are about to graduate there is one reason—the community of which you are part needs doctors. In its own interests and to serve its own ends, this society has organized medical schools and has permitted and encouraged you to enter medicine and to complete your curriculum. Since the war began, your own personal development has not been violently interrupted for the simple reason that it was recognized that, as graduates in medicine, you could give greater service to the community. It was not because you in your own persons are so precious that it was agreed that, though all else perished, all would be well should you remain. You, as individuals, were not regarded by the rest as exquisite flowers blooming on the dunghill that is society. You are the servants of the people and you have received special consideration because it was recognized that, in return, you could render special service to the community in its present dire need. In my view, none of you should have accepted privilege unless you meant to repay. In peace, as well as in war, this argument holds. Whilst some, as potentially capable as you, are dragged from school to earn money for others at the expense of their own possibilities for further self-development, you are permitted by the society that needs your special and devoted service to continue in tutelage and spend your adolescence in eager intellectual adventure. In war, whilst others must leave the quiet of the University cloister to be thrust into strange and noisome environments and to engage in occupations that have no relation whatsoever to their civil vocations, you are permitted to continue, to graduate and to serve in your own professional capacity. Your careers are not disrupted by war; they may be temporarily deflected but they are actually expanded thereby.

It may be that some of you may wish to present the view that medicine is an instrument of peace and that to transform it into a sword is an offence against its high purposes. I choose to think that the social purpose of modern medicine is that of banishing from the earth all those agencies, living and non-living, which cause defect and derangement in the individual and in the group; of producing, through the application of science to human affairs, an "optimum" environment in which mankind shall flourish; and of creat-

ing, through deliberate and conscious selection, types of humanity which, in virtue of their constitutions, shall be able to enjoy to the full the advantages of this environment. Medicine is concerned with the waging of ceaseless war, war upon all disease-provoking agencies, bacteria, personal and public habits, ignorance, superstition, false doctrine; against anything and everything that hinders the further and the higher development of mankind as a species and as a social organism.

Our profession must, of course, condemn war between human societies since such war is demonstrably dysgenic; but surely if the profession is satisfied that our way of life, not so much because of what it is as because of what it promises in terms of human and social betterment, is an experiment in social biology which must not be brought to an end by forceful interference from without, then it must play its part in the war that is now being waged. You are required, as I was required, to orient yourselves in relation to it.

Throughout history, as I read it, each and every human society, in the course of its own evolution, has developed a political creed which in its turn has fashioned the social structure. In order to protect this from outside interference or in order to impose this political creed or social pattern upon neighbouring communities, societies have armed themselves, have created more or less organized military forces. These have been, in their origin and purposes, instruments devised by human societies to give effect to the public will, to protect or else to propagate political or social ambitions, these being defensive or offensive. In the more primitive societies, the political and sociological views which dominate the whole community are those which are held and expressed by powerful minorities, by individuals such as tyrants, despots, dictators, or by small groups such as feudal families or terrorist parties. When this is so, all social institutions are, of course, controlled and used by the predominant minority to serve its own ends. So it is that an army has frequently been the instrument used by a political minority to impose its will upon a people or peoples. In a world in which prejudices, preferences and points of view have so often been thrust upon the indifferent and the unwilling by a display or by the exercise of armed force, the army has always been a double-edged social tool. It has provided protection under cover of which a society has quietly pursued its own chosen form of development; it has also been used by tyrannical persons and parties to subordinate the people and to retard, if not to prevent, social evolution.

We, as a society with a long and very eventful history, have long realized that an army is a source of potential danger and we have taken steps to ensure that the control of our armed forces should rest in the hands of the people, that they should be governed by the elected representatives of the people in Parliament. This being so and since I am of the opinion that in this world, as it now is, the maintenance of organized armed forces is unfortunately necessary, I am willing to serve in them.

I am willing to serve for another reason also. The army of to-day is not the army of yesterday, not so much because weapons have taken on new shapes as because our political and social aspirations have altered and become more dignified with growth. There came a time in our history when we found ourselves the uncomfortable, even unwilling, possessors of a far-flung empire, bequeathed to us by former acquisitive generations which cultivated political notions that seemed to us to be sadly outmoded and mistaken. We watched this empire crumble, as it was bound to do, since much of it was founded, not on colonization but on exploitation, and we were content, for the desire to impose our will on others by force had departed from us. As we watched, we saw, as by the operation of natural forces, the replacement of an empire by a commonwealth and we knew that what we saw was good and sound and desirable, a model for a new and a better world. With this change, the armed forces, which formerly had been used for the expansion of privilege and power, now assumed the guardianship of the evolution of a group of human societies, an evolution which would see the self-development of each and all of the components of this federation of free peoples. The soldier became a policeman being used to prevent violence rather than to repress it.

It would seem as though in the history of each politico-social group there inevitably comes a time when its people burst its political boundaries and swarm over the territories of its neighbours. It is as though there is a migratory phase in the developmental history of a human society during which the imperialistic spirit flourishes and the urge to dominate and subjugate others is uncontrollable. It is perhaps reasonable to regard this phase as one which is characteristic of political and sociological immaturity. In Europe the different human societies have not all achieved the same degree of maturity. Some are relatively old, some are young. We, as a people, have grown up and have passed through the jingoistic stage of our development into a nation. The present conflict is, in the ultimate analysis, a struggle between mature and immature political and social philosophies, between an ancestral imperialism and a modern democracy.

I personally regard war as an outmoded silliness, as an absurdity of political juvenility. But I am willing to drape myself in *barathea* and bedeck myself with stars for the reason that I am of the opinion that our particular social structure is threatened, that it is worth protecting, and that there seems to be no other way of preserving the ideals that have always claimed my devotion than by fighting.

You may wish to argue that medical men in uniform do not fight and that I indulge in cheap heroics. I retort by saying that in war, as it is now fought, every doctor in the country is personally and directly concerned professionally with the task of conserving man-power in order that the battle may be nourished. Every one is necessarily militant in the exercise of his professional skill though it may be said by the cynic that the doctor does his killing by proxy. No matter what you do or where you do it everyone

of you will be serving one end, the production and maintenance of the maximum lethal force for use in war. You may be a civilian exhibiting your healing art in the nursery; on the staff of a civil hospital which attempts to overtake its waiting list; on the staff of an E.M.S. hospital ever prepared to repair the human wreckage of air-raids; or officers in the medical services of the armed forces; everyone of you will be contributing to the war effort: will be harnessed to the chariot of war.

In total war, fighting, the attempt to defeat and overthrow the enemy, is not restricted to such as bear arms and wear uniforms. All the available energy of the community is used to drive the engines of war and there is no essential difference between the services of those who sail the ships, who fight the fires, who fire the guns, who till the land; every man, woman and child of this country is at war with every man, woman and child of Germany. Differences in the colour and cut of clothes do not determine differences in the kind or the quality of the services rendered by individuals to society. For conventional reasons, mainly, members of the armed forces wear uniforms. A uniform allows its wearer to be recognized for what he is. A modern military uniform is a working dress, being in harmony with the tasks which the wearer is called upon to perform; it is a battle-dress. All individuals officially associated with the armed forces wear uniform in order that they may more easily orient themselves in a military milieu and claim the authority, rights and privileges of recognized militants.

It is recognized that it is easier for individuals to share a common aspiration if they are dressed alike. So it is that clergymen and postmen, soldiers and boy-scouts, rotarians and Wrens are uniformed, their clothes and their uniformity help their wearers to behave according to the particular code that is characteristic of the group. Most people derive pleasure from being in a uniform of some kind and in all of us there exists, to a greater or lesser degree, an urge to merge ourselves in a group, a dislike of isolation and loneliness. Almost everybody finds it necessary to join some kind of organized group, a church, a club, a society, a party. To symbolize this allegiance to the group, everyone eagerly dons one or other variety of the old school tie, the coloured shirt, the pigmented rosette, and takes a satisfying part in one or other kind of exciting or narcotic ritual. To join a group, to follow a flag, to sing a chorus, is to find that much personal responsibility has been lifted from one's shoulders, for no longer is one required to make decisions and to choose between alternatives which do not appear to be distinguishable. At the same time one becomes endowed with the might and the authority of the group, so much larger and more powerful than oneself.

To join the Army is to escape the responsibility of making decisions which affect the individual. Decisions are made by others "higher up" and so the Army can be, for those who dislike balancing on the edge of doubt, what a church or a political party so often is, a system in which omniscience

and omnipotence are concentrated in the higher ranks and which demands from the lower only obedience and efficiency. There is nothing particularly meritorious in being in uniform. Those who wear such can claim no greater social worthiness than those who are not so garbed. I should have no difficulty whatsoever in proving to myself that my present contribution to the community cannot be compared in terms of quality, with those now being made by such of my colleagues who have remained in mufti to carry on their own work in this University. For obvious reasons—the great expansion of the fighting forces, the evacuation schemes, the creation of the E.M.S., the dispersal of industry—there came into being an urgent need for a planned redistribution of the medical man-power of the whole country. It was reasonably decided that certain categories should be preferentially employed for certain purposes. Thus, medical men with territorial army commitments were encouraged to serve with the armed forces; young men recently graduated, because of their relatively high degree of physical fitness and because of the lightness of their loads of social responsibility, were nominated for the medical services of the Navy, Army and Air-force; other categories were earmarked for service with the E.M.S., or persuaded to remain in general practice. In this way there developed a sartorial sectioning of the medical profession into the coloured and the plain and, as always happens when differences of this kind are created, values were given to these differences and disharmony arose. It cannot be too strongly emphasized that there has been no real division of the profession but only a redistribution, which may or may not have been faulty. This redistribution was devised and controlled by the profession itself so that if any of you should find yourselves in uniform, you will not have been the bemused victims of some press-gang, you will have been selected for this particular form of national service by your peers.

Those of you who do join the R.A.M.C. will be fortunate, in my opinion, for, being young, it is highly probable that you will serve in the capacity of regimental medical officer and thus encounter the unique opportunity of rapidly discovering what kind of man you really are. In battle you will live dangerously and you will feel the grip of stark fear; you will be unarmed amid violent indiscriminate lethality; to you the hurt and the frightened will turn for easement and comfort; through your devoted service the profession of medicine will gain added dignity. The work that you do, under conditions which will range from the merely inconvenient to the utterly impossible, will be of the very greatest importance for it is upon the quality of this initial treatment that all the rest depends.

But battles are rare events in war. Most of the time is spent in preparation for combat or in the licking of wounds and the work that you will do in quiet times is of far greater importance than that which you will attempt under fire. The regimental medical officer quickly finds that a knowledge of medicine is not enough. The battalion to which he is attached is a community composed of a number of highly specialized parts, each of which

has its own special function to perform. None of these parts is complete in itself; they are mutually interdependent and together they form one integrated whole, the unit. Training has for its object the achievement of this unity. No one can do more to help in its achievement than the regimental medical officer. His combatant colleagues do not need to know the principles or the techniques of doctoring but the medical officer must know sufficient of the principles and techniques of fighting to be able to relate his own professional activities to those of the unit as a whole. His colleagues are not required to become doctors but the doctor must become a soldier.

The army that you will join is not an army composed of illiterate serfs commanded by landless squires. It is a very representative sample of the young adult population of this country and will offer to you a unique opportunity of learning the elements of human and social biology, subjects of the very greatest value to you in your professional career yet subjects which you will not have encountered in your undergraduate curriculum. Your professional duties will require you to help healthy men to be healthier and you will come to know more about the small compact human community and about the individuals comprising it than any farmer knows about his herd of livestock, for you will be dealing not only with the bodies of men but also with their minds. If you wish to take advantage of the opportunities, you can gain more of permanent value to yourselves from a short and concentrated experience as a regimental medical officer than you could from years spent in the wards of a hospital or in general practice. The medicine that you will practise is the ideal medicine, disease prevention. You will be living in an atmosphere in which it is accepted by all that to be healthy and to keep healthy is the duty and the responsibility of every individual; that to become ill or unfit through ignorance or through disregard of the ordinary simple rules of personal and public sanitation is an offence against oneself and against the community. You will be in medical charge of those to whom the future belongs and not be hopelessly engaged in placating the senescent and the spent. Your teaching and your personal influence can be productive of results of profound importance to society, for you will be shaping the views and habits of those who, after the war, will be called upon to build the world anew.

I confess quite frankly that I envy you who stand so eagerly at the threshold of adventure. My decrepitude condemns me to a position of sessile seniority; were I granted one magical wish, I would be young again so that I might once more be a regimental medical officer and serve alongside that very wonderful person, the ordinary man, whom to know is a privilege and an inspiration.

GASTRIC DISORDERS IN THE ARMY.¹

By E. T. D. FLETCHER, M.B., B.Ch., M.R.C.P.

GASTRIC disorders are very prevalent in the Army and evidence as to their incidence is given below.

Experience in civil life and at one of the Emergency Medical Service Hospitals has suggested that it may be possible to separate these various disorders by their symptomatology, and a brief outline is given as to how this may be attempted. The importance of this is manifest, for much time and money can be saved and it may be possible to reduce the number of X-ray examinations. This skeleton scheme also affords a yardstick by which results can be gauged and provides a background against which unusual cases stand out.

INCIDENCE.

In a recent issue of the *Bulletin of War Medicine*, the Reviewer says that the incidence of gastric trouble in the Army is greater than that of all other diseases combined, and this will be generally agreed. He says that ulceration is the commonest diagnosis, that from the history it is commonly of long standing, and that the duodenal type outnumbers the gastric. He also says that the X-ray frequently shows no abnormality in the duodenal cases, and that the Army diet is deficient in vitamin C.

This has not entirely been the experience at the Preston Hall Emergency Hospital, for the gastric cases (so far as they can be separated from the duodenal in the way to be suggested) outnumber the duodenal. At the same time this review is the first authentic statement on the problem and should be given due weight. At any rate there is no difference of opinion as to the incidence of dyspepsia in the Army, nor is there any serious difference as to the fact that the incidence in Army life differs significantly from that in civilian life.

DIFFERENTIAL DIAGNOSIS.

The subject will be covered if a bald statement is made of the syndromes which may herald their approach with gastro-intestinal symptoms and then only those which might genuinely be confused. Perhaps it would be useful if they were classified under the leading symptom which they usually present. Naturally this is only a rough guide but it covers at any rate all the cases which are likely to present difficulties:

Pain in the epigastrium.

Pulmonary tuberculosis;

Gastric crises of tabes dorsalis;

¹ A lecture delivered before Medical Officers of the Kent Area, at the Military Wing, Barming Heath Mental Hospital, on November 2, 1940.

Angina pectoris and coronary thrombosis;
 Infective type of spondylitis;
 Chronic pancreatitis;
 Diaphragmatic pleurisy.

Vomiting.

Vomiting of cerebral origin;
 Uræmia;
 Glaucoma;
 Pernicious anæmia (as an early symptom of jaundice).

Hæmatemesis.

Cirrhosis of the liver;
 Œsophageal varices;
 Chronic nephritis;
 Aneurysm;
 Any syndrome in which hæmorrhage is a common feature, e.g. leukæmia, splenic anæmia, hæmophilia, purpura, etc.

The other symptoms found in chronic gastric disorders are not usually of a sufficiently leading or misleading nature to confuse the diagnosis.

It will be noticed that no mention is made of cholecystitis, but the differentiation of gall-bladder and gastro-duodenal troubles is a very difficult problem and every physician is constantly on the alert in this matter.

How it is Suggested the Problem may be Simplified from the Service Point of View.

To be of any practical use either to the hospital physician or to the R.A.M.C. officer the problem must be simplified and a solution found which can be applied without endless X-rays and without many complicated tests.

The easiest way is to go back to symptomatology. Although experts will have none of it, it works fairly well and is a great help in dealing with large numbers of cases. In this way all cases of chronic gastro-duodenal disorders may be divided into seven groups as follows: (1) gastritis; (2) hyperchlorhydria; (3) gastric ulcer; (4) duodenitis; (5) duodenal ulcer; (6) carcinoma of the stomach; (7) gastric symptoms due to disease in another part of the gastro-intestinal tract, e.g. appendicitis or colitis; and an attempt made to separate them to start with on a symptomatological basis. In practice Group 6 is hardly ever seen and Group 7 comes under Group 2 in the great majority of cases.

Gastritis.

Acute gastritis is not, of course, a chronic disorder and need not be considered.

Symptoms.—Pain or discomfort in the epigastrium immediately after food, relieved by vomiting and bringing up wind. A good appetite which is satisfied after a few mouthfuls of food: breakfast is the best meal of the

day and supper the worst. The vomit contains mucus and the man is definitely depressed and feels ill. He is generally constipated and the tongue is very dirty.

There may be a long history of these attacks.

A test meal should be given to try and confirm the diagnosis. All the apparatus required is a Ryle's tube, a burette and stand, some decinormal alkali, a 10 c.c. pipette and beaker and three bottles—Töpfer's reagent, phenolphthalein, and iodine. Nurses can easily be trained to take off the specimens. After a little practice the actual titrations, etc., for a complete test meal take about twenty minutes. In gastritis, of course, much mucus will be found in each specimen and the free and combined acids are very low. The presence of bile can be seen without actual chemical tests.

Treatment.—Great care should be taken in these cases to see that the teeth are in good order and it is probably one of the two syndromes in which pyorrhœa plays an important part. Even if constipation is not a feature, it is a good plan to give some regular colonic irrigations for two weeks every other day, as this seems to help the gastric condition.

The patient should be starved for two days with plenty of water and then put on light milk feeds and gastric lavage with a Ryle's tube (if possible two-way) each morning. This should be stopped at the end of a week and the diet should gradually be increased, a fairly large dose of hydrochloric acid being given after each meal. Vitamin B either as Bemax or Betaxan may be given before meals. On about the tenth day the patient should start long walks and regular exercise, and he should be returned to his unit in the middle of the third week with an iron tonic.

No gastric case of any sort is allowed to smoke in hospital and alcohol is, of course, forbidden to service hospital patients except on special conditions.

Hyperchlorhydria.

These patients have pain or discomfort in the epigastrium $\frac{3}{4}$ to 1 hour after meals and it is relieved temporarily by milk or fluid and, for a long time, with alkalies. There is no vomiting, but waterbrash and acid eructations frequently occur. It may be associated with lesions in other parts of the alimentary tract and is one of the easier gastric conditions to treat. It is sometimes associated with pyloric spasm in which case the patients complain of "cramp" in the abdomen of a severe nature.

To confirm the diagnosis, a fractional test meal should be carried out. A high acid curve may be found, but there is a tendency in this condition for mucus to accumulate in the stomach and this may interfere with the findings. If so, it may be wise to wash out the stomach first and give the porridge a quarter of an hour after, and then take the acid values disregarding the resting juice. Tobacco and alcohol are amongst the direct causes of this type of gastric disorder.

Treatment.—The teeth and bowels are important but probably not so decisive as in chronic gastritis.

Starve for two days giving plenty of water and alkalies every three hours. Then start milk feeds, giving a dose of alkali after each.

Owing to the possibility of pyloric spasm this is the type of case where belladonna is so useful.

Gradually increase the feeds and return to unit in two weeks with the suggestion that alkalies may be necessary for some time.

Gastric Ulcer.

These patients complain of a localized pain in the epigastrium soon after food. The exact time relationship will depend on the position of the ulcer but it will always be the same. There is no vomiting as a rule and more food makes the pain worse. If vomiting occurs, it does not relieve the pain for more than a moment. Alkalies relieve the pain but as a rule only temporarily. There is no loss of weight. There is tenderness in the epigastrium and the upper part of the rectus abdominis tends to be rigid. The appetite is good but the patient will not try to eat because he knows it will bring on the pain but fats are taken well. Hæmatemesis may occur. The tongue is usually clean. Worry makes the pain worse and relapses can often be related to unhappy events in the patient's life.

Treatment.—With this history gastric ulcer may be provisionally diagnosed. A glass of milk only should be given every two hours in all cases, but starvation should never be ordered because it is probable that self-digestion of the gastric mucosa occurs in these cases. After a few days' rest and milk diet, an X-ray should be taken with a barium meal and, at the same time, occult blood should be tested for in the stool. Careful attention should be paid to the result of the occult blood, because, although imperfect, it is the best guide we have. If it is present and the radiologist reports an ulcer crater, the case may be regarded as proven from the practical point of view. And now the real difficulty must be faced. What should be done in the case of a soldier patient in such circumstances?

If it is recommended that the man should be sent before a Medical Board, he will almost certainly be discharged from the Service on this evidence. The question, therefore, of the man's trade and ability should be carefully considered and a decision made as to whether he will be more useful in the Army or in civilian life. His ulcer can be completely healed by medical treatment but not under six weeks and therefore an attempt should be made to visualize to what extent he is liable to relapse. His psychological make-up should also be considered. If the conclusion is reached from these various considerations that the patient is more useful in the Service, he should be put on the full ulcer regime for six weeks, but no attempt need be made to obtain radiological evidence of a healed ulcer for the following reason. The ordinary gastric ulcer heals in six weeks in civil life and at the end of that time, or shortly after, the man resumes his work. If the Service man's ulcer has not healed, it must be either because

he has a constitutional defect and cannot heal his ulcer, or because extraneous circumstances militate against its becoming healed. In both circumstances, under controlled conditions in hospital, the man is of no further interest as a soldier. If, therefore, he rejoins his unit with an unhealed ulcer, he will relapse and on return to hospital he will be immediately recommended for a Medical Board.

So far, these cases have not been treated by duodenal intubation, but it would be well worth trying, because civil experience led to the conclusion that the relapse rate was lower in the cases so treated.

Duodenitis and Duodenal Ulcer.

It is impossible to differentiate these two conditions clinically. The patients complain of pain to the right of the umbilicus one and a half to two hours after meals. The pain may be severe but it is more often of a "gnawing" character. It is relieved by more food and by alkalies. Vomiting is very unusual. The characteristic night pain is fairly constant. Appetite is good and these patients will often eat well, probably because the pain comes on later and so the punishment is not immediate. Melæna may of course occur. As a rule the men are older than the gastric cases.

Treatment.—Unless their general condition and physique is poor, these men should be given a chance. As a rule they are of good type and useful to the Service. X-rays are not usually asked for but the treatment is controlled by repeated tests for occult blood. If the result of the fractional meal shows a low acid curve, however, the diagnosis is suspect and X-rays may be required to exclude a new growth, duodenal diverticula, etc.

An X-ray in the first place is not asked for because from the Army point of view a great deal of importance is not attached to an ulcer niche or crater. If a crater is found and the case is a proven one of duodenal ulcer, the chances are that with thorough treatment the ulcer will heal and the possibility of relapse in this type of case is not nearly so great as in gastric ulcer. If no ulcer is reported and the X-ray diagnosis of duodenitis is made, the outlook from the Service point of view is worse, for experience has shown that these cases are much more difficult to treat and tend to relapse very readily. If, therefore, after treatment the man relapses and comes back to hospital, it must be concluded that he is either a case of duodenal ulcer with a constitutional tendency to relapse, or a case of duodenitis; and in either case he should be recommended for a Medical Board. This may seem a roundabout way of coming to a decision, but so many of these men make good soldiers and, further, good N.C.O.s, that it seems worth while making at any rate one attempt to keep them in the Army.

Groups 6 and 7.

Carcinoma of the stomach has, of course, no place in a paper of this sort; and Group 7, gastric cases due to disease in other parts of the gastro-

intestinal tract, nearly all fall into the group of hyperchlorhydrias, and therefore special care must be taken to exclude them when considering that group.

Alkalosis.

This shows itself first by nausea and a relapse of all symptoms. It is a good thing always to bear this in mind, for if alkalies are stopped temporarily, the subsequent progress of the case may be favourable.

The *psychogenic factor* looms large in practice but is not mentioned here and the reason is evident. A particular problem is being considered from a particular point of view and, although every medical officer will automatically consider the psychological factors in each case, it is unwise to include any form of psycho-analysis in the therapeutic armamentarium.

TABLE.

	<i>Gastritis.</i>	<i>Hyperchlorhydria.</i>	<i>Gastric Ulcer.</i>
Pain ..	Immediately after food. Relieved by vomiting. Good appetite soon satisfied. Breakfast best meal of the day. Fats taken badly.	$\frac{1}{2}$ -hr.—1 hr. after food. No vomiting, but py- rosis present. Good appetite.	Pain usually very local- ized, soon after meals, sometimes in back. Vomiting unusual, but relieves the pain when it happens, although only temporarily. Ap- petite good, fats taken well.
Food ..	More food leads to more vomiting. Vomit con- tains ++ mucus. Man feels ill and depressed, headache, constipated.	More food leads to tem- porary relief of pain. Pain c/o more than illness.	More food leads to more pain. Man well, but c/o pain.
Bowels ..	Constipated	Regular as a rule ..	Regular.
Tongue ..	Dirty tongue	Tongue not as a rule dirty.	Tongue clean.
Test meal	Mucus +. Low total and combined acids.	High acid figures ..	Acid figures normal or high.
Pathology	A chronic inflammation of the stomach wall with much oedema. Often associated with pyorrhœa.	A secondary gastric re- action to gall-stones, appendicitis, colitis, etc. Pyorrhœa may be a factor. May be associated with pyloric spasm leading to "cramp" in the ab- domen. The "alco- holic" type belongs to this group.	Ulceration of gastric mu- cosa. Ætiology un- certain.
Alkalies ..	Have little effect	Relieve the pain ..	Relieve the pain.
Exercise ..	Does good	Does good	Makes the condition worse until conva- lescence is established.
Paradism to abdom- inal muscles.	Useful	Useful	Not advised.
X-ray ..	Not essential	Not necessary except where another part of the alimentary canal may be involved.	Essential to indicate position of ulcer and likelihood of complica- tions.
Occult blood	Seldom found	Absent	Repeated examinations are necessary.

In the table will be seen a rough guide to the differences which are found in the three main varieties of gastric disorder described in this

article. A very careful history, taking account not only of all the symptoms but of exactly how they occur, will lead to a separation of these three groups. Treatment based on this separation will be more successful.

The outline given here is imperfect. There are border-line cases, there are atypical cases, but it is a definite standard against which the unusual stands out and is remembered: it is a spar to which one can cling in the bewildering maze of gastro-duodenal pathology and, so far as a definite statement is permissible, it appears to simplify and shorten the treatment of soldiers.

SUMMARY.

An attempt is made to separate the chronic gastric disorders from their symptomatology, this attempt being supported by fractional test meals, tests for occult blood in the stools, and X-rays where necessary.

No mention has been made of Army diet but, if any suspicion is entertained as to its vitamin C content, it would be wise to give orange juice from the commencement of treatment, and in view of the fact that deficiency of ascorbic acid has been repeatedly shown in gastric ulcer, it might be a good plan to make this a routine addition to treatment.

Editorial.

TRANSFUSION AND WAR.

BLOOD volume reduction from blood or plasma loss is now universally acknowledged to be the most important cause of the progressive train of symptoms conveniently called "shock." Consequently all are agreed that the fundamental requirement of casualties exhibiting these symptoms from this cause is prompt and adequate restoration of blood volume. This relieves the circulatory embarrassment caused by defective cardiac filling and poor cardiac output whereupon peripheral and general symptoms themselves disappear. Other essential or conservative measures such as arrest of hæmorrhage, relief of pain, assisting the cerebral circulation by the head-low position, fluid administration, moderate warmth or oxygen for cyanosis should not be neglected, nor should those who exhibit the symptoms of "shock" be transfused unless they be judged to be suffering from blood volume reduction. Detailed investigations [1, 2] made on air raid casualties and accident cases have shown that, though an acute blood loss be as much as six or seven pints, life may still endure for a few hours in those whose injuries are not overwhelming and can indeed be saved if sufficient protein fluid be transfused to effect an approximately quantitative restoration of blood volume. Such casualties may be assumed to have had a normal cardiac muscle before wounding so that the danger of overloading the circulation with a massive transfusion of protein fluid is small; a more likely danger is imperfect restoration of blood volume; subsequent operation is then badly borne. Saline and other crystalloid solutions have only a temporary effect upon blood volume and with them the danger of pulmonary oedema is great unless they are put to their proper use, that is, the relief of tissue dehydration. This last is a feature more likely to be met with in battle casualties who suffer delay in evacuation, rather than in air raid casualties who usually have opportunity to be transfused soon after wounding. For the Services the problem of transfusion in war has been firstly to train sufficient numbers of officers and men to be skilled at intravenous work as well as in the recognition of the different morbid states which give rise to the clinical symptoms of the "shock" syndrome and, secondly, to supply protein transfusion fluid with equipment for its administration to be in the right place at the right time and in sufficient quantity. Much progress has been made in the matter of supply since the beginning of the war. At the outset the B.E.F. was furnished with stored blood the life of which was approximately fourteen days provided that proper refrigeration was meticulously carried out and for this the Army was splendidly equipped. Research enabled this period of storage to be lengthened certainly to four weeks whilst an extreme case

was the successful use of blood seven weeks old during the Dunkirk campaign [3]. Since that time durable blood substitutes suitable for blood volume restoration and which do not require refrigeration have been steadily evolved. Filtered fluid citrate plasma, which experimentally had been found superior to the more easily prepared serum [4], and which is stable without refrigeration for at least eighteen months, solved the problem for reasonably temperate climates. Plasma dried by the low temperature low pressure process provided a volume-restoring blood substitute stable even under tropical conditions but which carried the disadvantage of needing pyrogen-free distilled water for reconstitution thus greatly increasing the bulk to be transported. Both these blood substitutes have been favourably reported on though fluid filtered plasma has until recently had the disadvantage that a proportion of bottles tends to form fine clots after long storage. In this number we publish the latest advance in this field, the production of a stabilized plasma in which there is no tendency to clot on storage and which will apparently endure extremes of temperature without deterioration.

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Clinical and other Notes.

RECURRENT INGUINAL HERNIA.

BY LIEUTENANT-COLONEL N. HEATH,

MAJOR J. J. MASON BROWN,

AND

MAJOR K. G. W. SAUNDERS,

Royal Army Medical Corps.

THE first *Bulletin* of the Army Medical Directorate states that there are far too many recurrences in straightforward cases of inguinal hernia after operation and goes on to suggest that this is due to two possible causes, (1) inefficient operative technique; (2) incorrect after-treatment. The conclusion that the first of these is the predominant one has been forced upon us by the series of cases operated on in a Military Hospital.

Since the opening of this Hospital and during the period November, 1940, to July, 1941, 175 cases of inguinal hernia have come to operation. Of these 175 cases 18 (approx. 10 per cent) have been recurrent hernias and 11 have been cases of direct hernia. It is usually stated that recurrence is more common in direct hernia and yet the proportion of recurrences is almost twice that of direct hernias and in addition only two of the recurrent hernias could possibly have been initially direct hernias.

A detailed analysis of the 19 cases of recurrent hernia (one case was not operated on) gives astonishing results. Of the 18 cases operated upon 3 were direct hernias and, in every one of the remaining 15, a congenital or funicular sac was isolated and removed. As the first operation had been carried out since the war began in all but one case, this is capable of only one interpretation, viz., that the sac had been overlooked or incompletely removed at the initial operation. To put it more bluntly 83 per cent of the recurrences were due entirely to indifferent surgery. The cases were representative of the surgery of all parts of the British Isles and were operated on originally in Military, E.M.S. and Civilian Hospitals and were all young healthy vigorous subjects whose musculature could not be held responsible for the recurrence. In brief the details of the 18 cases were: right side 10, left side 5 and in three the side was not stated in the record remaining in the hospital. Funicular sacs were found in 11 cases and in 6 of these were of large size and in our opinion could only have been the original sac. Congenital sacs were found in four cases and in three no sac could be found. These three cases require further consideration. One had had no previous repair and the closure of the very large internal ring gave a satisfactory

immediate result. The remaining two had each suffered three previous operations on the hernia. One of these cases had been operated on by Gallie's method a year previously and a lattice work of individual strands of fascia was found fulfilling no useful purpose in front of the spermatic cord.

The case which refused operation is the most disturbing. He had been operated on four times previously and his history was briefly as follows: 1st operation, bed 14 days and hernia recurred on the first day out of bed; 2nd operation, bed 21 days, recurrence exactly the same one month later; 3rd operation one month in bed and recurred before he left the hospital where the 4th operation was performed and a fascia lata graft was employed. The hernia recurred immediately he returned to duty. On examination the inguinal canal was sound but he had a very large femoral hernia and a muscle hernia the entire length of the outer side of the thigh. The suggestion that this was a different hernia was indignantly refuted by the patient who maintained that its size and shape had not been affected by any of his four operations.

Various types of repair were encountered varying from none at all to the bringing of all layers in front of or behind the spermatic cord. In one case there was no sign that the external oblique aponeurosis had been opened previously and in three cases the large sac could be seen on exposing the cord before its coverings had been disturbed.

Papers on recurrent hernia usually put the blame on failure to repair the inguinal canal but the majority of our cases were certainly due to the persistence of the original sac. It would seem, therefore, that only too often is an inguinal hernia operated on by the young surgeon without adequate assistance or supervision. It is inconceivable that any surgeon of experience could have missed such obvious oblique hernia sacs. Repair of the canal, as is well known, is of no value when the hernial sac remains. Another reason for failure is the error of searching for the sac in the lower limits of the cord and so missing the smaller funicular type of sac.

From the cases operated on in this hospital the cause of the recurrence has therefore been inefficient operative technique.

SUMMARY.

(1) Of nineteen cases of recurrent hernia sixteen were certainly due to inefficient operative technique in that the original sac had not been removed.

(2) It is axiomatic that the essential part of the operation for oblique hernia is the isolation and complete removal of the sac and the method of repair is of secondary importance.

(3) A high recurrence rate is likely to discredit the operation and lead to an increase in the number of soldiers refusing operation.

We wish to acknowledge indebtedness to Colonel A. Hedley Whyte for his advice in the preparation of this paper.

THE DRAYMAN'S LIFT.

AN ALTERNATIVE METHOD OF LOADING A STRETCHER BY TWO BEARERS.

BY LIEUTENANT-COLONEL J. T. McOUAT,

Royal Army Medical Corps.

UNDER field conditions there are frequently only two bearers available to load a stretcher and the method laid down in para. 80 of R.A.M.C. Training has the disadvantages that it is heavy on the bearers and hard on the patient. The ideal method should be dependent neither on the physical strength of the bearers nor on the stoicism of the patient; and it should be as speedy as is compatible with an easy and comfortable lift.



FIG. A.

The following was evolved from the drayman's method of lifting beer barrels which are on the whole heavier and more awkward than most wounded men. The essence of the lift is the formation by two bearers standing face to face of a rigid "arch" over the patient, the apex of the arch being formed by the bearers' heads pressed firmly together vertex to vertex and the rigidity being maintained by leaning inwards and taking the strain on the neck and shoulders. Theoretically the rounded upper surfaces of two steel helmets would not appear to form an ideal "keystone point" for a

rigid arch but in practice it has been found that there is no tendency to slip and that considerable pressure can be maintained. This firm bracing together of the two bearers is the secret of an easy lift and must be maintained whilst moving and carrying the patient.

The method can be applied in various ways. In the simplest application two bearers stand one on either side of the wounded man, as in fig. A, facing inwards and bending forwards head to head. Their lower hands are linked under the patient's knees; their upper hands grip the equipment braces over his clavicles. The bearers flex their knees to obtain this grip and lift the patient by straightening their knees. It has been found that



FIG. B.

in this way a fifteen stone man can be lifted without undue effort even by two small orderlies. The bearers then move laterally by short sideways steps and lower the patient on to the stretcher.

Alternatively, the lower half of the body may be raised by gripping the slack of the patient's trousers over the outer and upper aspect of the thighs instead of linking hands under the knees; in this case the grip should be high up on the thigh opposite the greater trochanter to avoid flexion and abduction at the hip. By this method it is possible to lift a case of fractured femur, provided a third bearer is available to exert traction on the injured limb or to support the splint.

Where space is limited as in a narrow trench the bearers should stand astride the patient as in fig. B. Here the upper bearer grips the equipment braces and the lower bearer links his hands under the patient's knees or

grips his trousers. In this case the lift is easy especially if each bearer supports his elbows on his knees but movement is not so easily carried out and, preferably, the stretcher should be slipped under the patient by a third bearer if such is available.

Various modifications can be devised to deal with different types of injuries. For instance, a case of fractured lumbar spine can be lifted in the prone position and a case of fractured pelvis should be lifted by the braces and the belt, preferably with a third bearer exerting traction on both legs; for all fractures of the lower limb a third bearer is essential.

The advantage of this lift can best be appreciated by trial. It is comparatively easy on the bearers and appears to be most comfortable for the patient who is carried, as it were, in a sling. In addition it is a quicker method than any other of loading a stretcher.

I am indebted to Serjeant L. S. Lee, R.A.M.C., for the original suggestion and for the illustrations which accompany these notes.

A CASE OF INTRAMESENTERIC RUPTURE OF THE SMALL INTESTINE.

BY CAPTAIN R. E. WATERSTON,

Royal Army Medical Corps.

GUNNER B., aged 20, was admitted to hospital as a result of a football injury. An opponent had taken a flying kick at the ball which was driven with great force into the patient's abdomen to the right side of the mid-line. He collapsed immediately and was taken to hospital complaining of severe abdominal pain. Shortly after admission he vomited, the pain continued severely and in the next twelve hours the pulse rate increased steadily.

He was transferred to the British Military Hospital, Peshawar, and was seen by me twenty-two hours after the injury. His tongue was dirty brown in colour and respiration was entirely thoracic. There was rigidity of the abdominal muscles and extreme tenderness in the lower abdomen. There was a small extent of dullness in the flanks but no fluid thrill could be elicited. There was no visible bruising of the abdominal wall. A diagnosis of peritonitis following rupture of a viscus was made. The patient stated that his bladder was empty at the time of injury and it seemed most likely that the rupture involved the intestine.

Under general anaesthesia the peritoneal cavity was opened through a lower paramedian incision and a quantity of serous free fluid with flakes of lymph was found in the peritoneal cavity. The lowest loop of small intestine was seen to be bruised, there were subperitoneal petechial hæmorrhages and a coagulum of lymph on its surface. The maximum point of injury was at an area some 8 inches above the ileo-cæcal valve and, at this point, at the junction of gut and mesentery, there was a subperitoneal

swelling which ballooned out both anterior and posterior layers of the mesentery and was visible from both sides. This swelling measured 1 inch



FIG. 1.—External aspect of the resected portion of ileum, showing the swelling at the junction of intestine and mesentery.

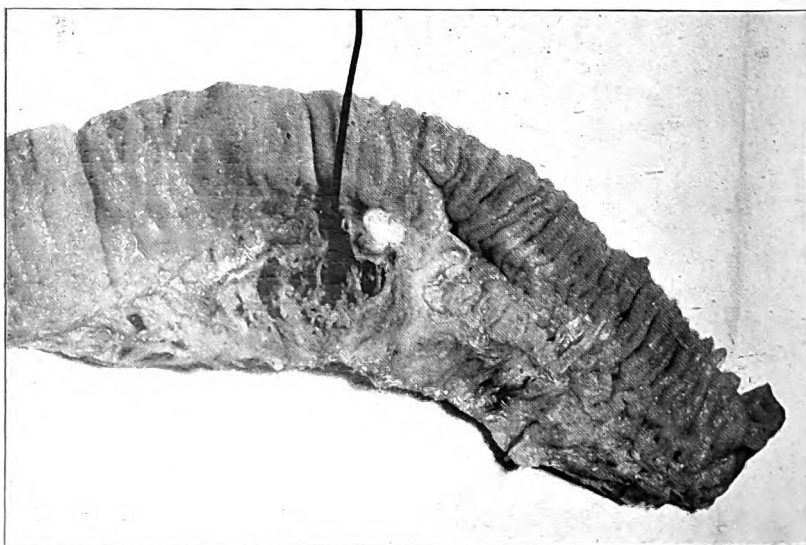


FIG. 2.—Section through the mesentery and intestine at the site of perforation with pointer in its orifice. The small cavity shown in section did not communicate with the peritoneal cavity.

in diameter and the peritoneum covering its upper and under surfaces was whitish in colour, lustreless and œdematous (fig. 1). It was evident that there was a rupture of the intestine into the mesentery and, as it seemed

advisable to remove the affected portion of mesentery to prevent spread of infection, the loop of bowel involved was resected and an end-to-end anastomosis was performed. The paramedian incision was closed and the peritoneal cavity was drained through a stab incision above the symphysis pubis.

The patient has made an uninterrupted recovery.

Examination of the resected loop shows that there is a rupture through the intestinal wall into the space between the two peritoneal layers of the mesentery. The perforation is roughly circular and connects the lumen of the intestine with a small space filled with intestinal debris (fig. 2). This formed the swelling which was found at operation.

The way in which the injury occurred is disputable. It is possible that the injury affected directly the junction of gut and mesentery and, following the formation of an intramesenteric hæmatoma, subsequent rupture of the intestine took place. It seems more likely that due to sudden increase in pressure in a distended loop of intestine an actual burst into the mesentery occurred at the time of injury. This supposes a momentary obstruction of the intestine to the increased pressure above the injury—a small kink would be sufficient—the ileo-cæcal valve forming the obstruction below. Such a mechanism of rupture is described but the usual site in these cases is on the antimesenteric margin.

In this case the rupture was incomplete in that the general peritoneal cavity was not immediately involved. This accounts for a delay of about twenty hours in the development of signs of general peritonitis.

I wish to thank Colonel J. Rowe, *M.C.*, Commanding British Military Hospital, Peshawar, for permission to publish this case.

Reviews.

STERNAL PUNCTURE. By A. Piney, *M.D.*, *M.R.C.P.* London: Wm. Heinemann (Medical Books), Ltd. 1941. Pp. 77. 1 coloured plate. Price 12s. 6d.

Sternal puncture has been the subject of elaborate studies by such authorities as Hynes, Israëls and Bodley-Scott, to mention only some from this country alone, and he is a bold man who would compile a book on the subject without reference to or quotation from these works. Yet Dr. Piney has dismissed and omitted these and all other modern authorities by a mere statement that their views are not "diametrically opposed" to his. It would be instructive to know how many experienced workers would agree that a 25 c.c. syringe is the instrument of choice for the obtaining of a specimen; how many would support the author's statement "that there is no peculiarity in the bone-marrow that would enable one to recognize that an aleukæmic blood picture was present; only blood examination can reveal this fact";

how many would accept the myelograms of aplastic anæmia as typical or characteristic; and how many, tyro or expert, would obtain the slightest information of value from the coloured plate? The book has a number of inconsistencies; thus one is adjured on one page to count 1,000 cells if one is to obtain a reliable result whilst on another the author confidently computes various indices (not further used in the book) from a mere 100. Nor is there any attempt to make clear the diagnostic value or the limitations of sternal puncture nor when it may need to be supplemented by the more extensive sternal trephine. It is unlikely that the present volume will attain the popularity achieved by Dr. Piney's previous books L. E. H. W.

TEXTBOOK OF PATHOLOGY. Fifth Edition. By Sir Robert Muir, M.A., M.D., Sc.D., LL.D., F.R.S. London: Edward Arnold & Co. 1942. Pp. vii + 991 with 599 illustrations. Price 35s. nett.

Ever since the first edition of Muir's Pathology was published in 1924 it has been regarded as one of the most reliable books on the subject in the English language. Although first and foremost a Scottish student's book it has also been very popular with English medical students. The book has especially appealed to the type of student who looks for authoritative statements and sound teaching. How often one has heard at the end of an argument: "But Muir says . . ." And there is nothing more to say.

The fifth edition is arranged on the same lines as the previous editions and the publishers are to be congratulated on maintaining the high standard of production in the face of war-time difficulties. There is no loss of clarity in the reproduction of the well chosen and excellent illustrations. The text has been thoroughly revised and much new material added to bring the book up to date.

Although essentially for students, it is safe to say that it will continue to occupy a prominent place on every laboratory bookshelf. It remains the most distinguished British textbook of Pathology. H. J. B.

Correspondence.

SHORTCOMINGS OF COMMERCIAL STEAM DISINFECTION APPARATUS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—The article on this subject by Lieutenant-Colonel A. G. Gadd, R.E., and Major A. W. Turner, R.E., in the January issue of the *Journal* is welcome as giving an engineering approach to a problem which has been concerning the medical profession for a considerable time. On this very subject an illuminating report was published as recently as the summer of 1941 by the Committee of the Royal College of Obstetricians and Gynaecologists to which we would refer anyone interested in this important matter. Reviews and correspondence concerning this report appeared in the *British Medical Journal* in the summer of 1941.

We think it should be said that research into the same problem has been going on at the Army School of Hygiene in collaboration with the Royal Army Medical College, and many of the findings of the authors of the article can be confirmed. In our experiments we have taken thermocouple readings in conjunction with the use of witnessing tubes indicating various temperatures and some interesting points emerged. For instance, tubes sometimes changed appearance at lower temperatures than was expected. This was found to be due to the existence of minute cracks in the glass, caused by faulty sealing, allowing steam to penetrate and melt the enclosed chemical.

Witnessing tubes are reliable, therefore, only when perfectly sound and, as the authors of the article point out are, when unchanged, a good indication of failure to disinfect. This research work is being continued at the Army School of Hygiene and the Royal Army Medical College.

Meanwhile, we would point out that a frequent cause of trouble in some installations tested by us has been absence of the required steam volume and pressure. Any attempt to work existing apparatus in conditions less favourable than the prescribed minima is, of course, doomed to failure from the outset.

We are, Sir,

Yours faithfully,

O. C. DOBSON,

Major, R.A.M.C., Army School of Hygiene.

FREDERIC EVANS,

Major, R.A.M.C., Army School of Hygiene.

STANLEY ELLIOTT,

Major, Royal Army Medical College.

April 8, 1942.

Notice.

HEPASTAB FORTE (BOOTS).

It is generally agreed that the most effective and economical method of administering liver is by hypodermic injection. Messrs. Boots Pure Drug Company have sent us particulars of their preparation "Hepastab Forte," a concentrated liver extract 2 c.c. of which is claimed to be therapeutically equivalent to 4,000 to 5,000 gramme of fresh liver given by mouth.

The preparation may be given intramuscularly or if necessary intravenously.

Once the blood count has returned to normal and all other symptoms have disappeared an intramuscular injection of 2 c.c. Hepastab Forte every two to six weeks according to the response is stated to be generally sufficient for maintenance treatment.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. All such articles or papers, etc., intended for publication must be submitted in **duplicate** through the proper channels, i.e., Commanding Officer and A.D.M.S., or D.D.M.S., to the Under-Secretary of State, War Office (P.R. (O)), and not to A.M.D.2, otherwise such articles are liable to be returned to the authors and this may cause delay in publication.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a *nom-de-plume*.

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A free issue of twenty-five reprints, or any lesser number to the extent applied for, will be made to contributors of Original Communications and of twenty-five excerpts, or any lesser number as above, in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past. Such free reprints or excerpts will, however, only be sent to those specifying their wish to have them and a request for same should accompany the article when submitted for publication, stating the number of reprints or excerpts required.

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MESSAGE FROM HER MAJESTY THE
COLONEL-IN-CHIEF, ROYAL ARMY MEDICAL SERVICES

The Director-General, Army Medical Services,
telegram given below to our Colonel-in-Chief,
following gracious message from Her Majesty The Queen

The Director-General,
Army Medical Services.

My sincere thanks to all ranks for the
on my birthday, which I have received with

ELIZABETH R., Colonel
Buckingham Palace

The Private Secretary to Her Majesty The Queen
Buckingham Palace.

Colonels Commandant and all ranks of the
Medical Corps, submit their most respectful
Colonel-in-Chief on her birthday.

Director-General
Army Medical Services

NOTICE.

LARGE numbers of Journals are being returned to the Manager undelivered. It would be of great assistance if changes of addresses are promptly notified to The Manager, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, The War Office (A.M.D.2), Whitehall, London, S.W.1.

ERRATUM.

VOL. LXXVIII, No. 6, June, 1942, page 258. Third line from end, after "especially" insert "clarified".

Authors are alone responsible for the statements
made and the opinions expressed in their papers.

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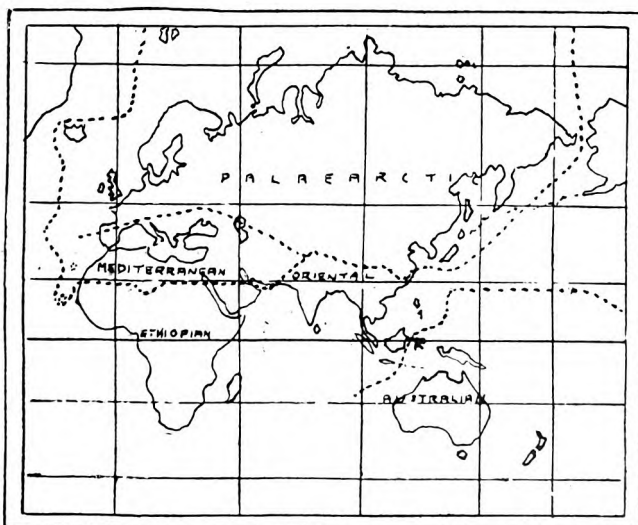
Original Communications.

A KEY TO THE ANOPHELINE MOSQUITOES OF THE MEDITERRANEAN REGION AND THE LANDS ADJOINING THE RED SEA AND THE PERSIAN GULF.

BY MAJOR T. T. MACAN,
Royal Army Medical Corps.

SCOPE AND PURPOSE.

THE world falls into a series of zoo-geographical regions in three of which, the Ethiopian or African, the Oriental or Indian and the Palaearctic with its subdivision the Mediterranean, Allied troops are at present operating. These regions are shown in the following map.



MESSAGE FROM HER MAJESTY THE QUEEN,
COLONEL-IN-CHIEF, ROYAL ARMY MEDICAL CORPS.

The Director-General, Army Medical Services, who sent the telegram given below to our Colonel-in-Chief, has received the following gracious message from Her Majesty The Queen.

The Director-General,
Army Medical Services.

My sincere thanks to all ranks for their loyal message on my birthday, which I have received with much pleasure.

ELIZABETH R., Colonel-in-Chief,
Buckingham Palace.

The Private Secretary to Her Majesty The Queen,
Buckingham Palace.

Colonels Commandant and all ranks, Royal Army Medical Corps, submit their most respectful greetings to their Colonel-in-Chief on her birthday.

Director-General,
Army Medical Services.

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Journal of the Royal Army Medical Corps.

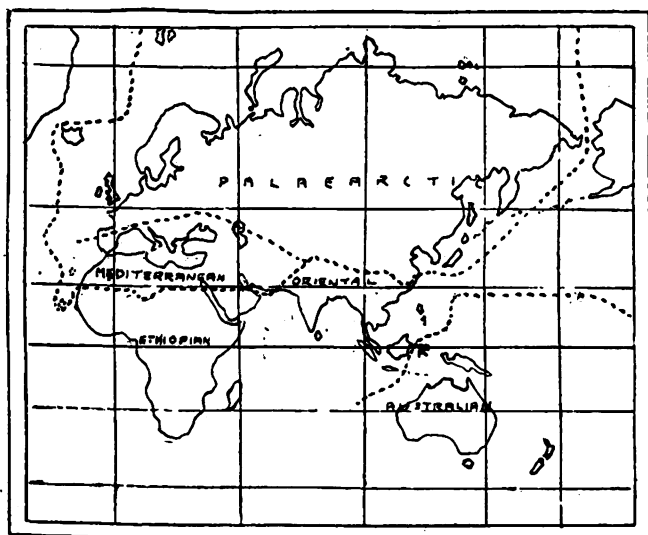
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2 A Key to the Anopheline Mosquitoes of the Mediterranean Region

There may be some attenuation of a fauna towards the boundary of a region, especially where geographical conditions change. Only a limited number of Ethiopian species are found in Abyssinia. There are also a few species which extend beyond the limits of one region and occur within the bounds

ANOPHELES SPECIES	Ethiopian Reg.	Abyssinia	S. Arabia	Egypt	N. Africa	Palestine	Syria	Turkey	Balkans	Italy	Turkistan	N. Iraq	S. Iraq	Persia	Persian Gulf	Baluchistan	E. Arabia	N. India	Oriental Reg.
<i>funestus</i> Giles																			
<i>garnhami</i> Edwards																			
<i>christyi</i> Newstead and Carter																			
<i>squamosus</i> Theobald																			
<i>pretoriensis</i> Theobald																			
<i>cinereus</i> Theobald																			
<i>arabica</i> Christophers and Chand																			
<i>gambiae</i> Giles (<i>costalis</i> Theobald)																			
<i>pharoensis</i> Theobald																			
<i>mauritanus</i> Grandpre																			
<i>rupicolus</i> Lewis																			
<i>dthali</i> Patton																			
<i>multicolor</i> Chamboulin (<i>chaudoyei</i> Theob.)																			
<i>sergenti</i> Theobald																			
<i>hyrcanus</i> Pallas (<i>sinensis</i> Wied) (<i>pseudopictus</i> Grassi)																			
<i>broussieri</i> Edwards																			
<i>hispaniola</i> Theobald																			
<i>marteri</i> Senevet and Prunelle																			
<i>algeriensis</i> Theobald																			
<i>bifurcatus</i> Linnaeus (<i>claviger</i> Meigen)																			
<i>plumbeus</i> Stephens (<i>nigripes</i> Steiger)																			
<i>maculipennis</i> Meigen																			
<i>elutus</i> Edwards																			
<i>superpictus</i> Grassi																			
<i>italicus</i> Raffaele																			
<i>sogdianus</i> Keshishian																			
<i>apaci</i> Marsh																			
<i>pulcherrimus</i> Theobald																			
<i>turkhudi</i> Liston																			
<i>stephensi</i> Liston																			
<i>moghulensis</i> Christophers																			
<i>theobaldi</i> Giles																			
<i>culicifacies</i> Giles																			
<i>fluviatilis</i> James (<i>listoni</i> Liston)																			
<i>habibi</i> Mulligan and Puri																			

"Ethiopian" Species —

"Palearctic" Species —

"Mediterranean" Species —

"Oriental" Species —

TABLE I.

of a neighbouring region. For instance most of the Oriental species do **not** occur north or west of the Indus valley but there are a few, notably **the** important carrier of malaria *Anopheles stephensi*, of which the range **extends** beyond this boundary to the east coast of Arabia and the Persian **Gulf**.

In general, however, each region has its own distinct fauna comprising species not found in any other region. The Anopheline fauna of the regions under discussion have been dealt with in the following comprehensive and recent works :

- Palaeartic and Mediterranean.—Martini, E. (1929-1931). In Lindner's "Die Fliegen der Palaarktischen Region." 11 and 12. Stuttgart.
 African.—Evans, A. M. (1938). "Mosquitoes of the Ethiopian Region II. Anophelini, Adults and Early Stages." British Museum (Natural History).
 Indian.—Christophers, S. R. (1933). "The Fauna of British India, including Ceylon and Burma. Diptera, IV. Family Culicidae. Tribe Anophelini." London.

The malariologist attached to the Army in India or Malaya has a comparatively simple task since his work lies well within one zoo-geographical region. The malariologist in the Middle East has a more difficult task since he is working near the boundaries of three zoo-geographical areas. The majority of the species encountered will be Palaeartic and Mediterranean but, in addition, there will be :

(1) A few Oriental species of which the range extends to Arabia, Persia and Irak.

(2) A limited number of Ethiopian species occurring in the North African Mediterranean Region.

In addition the attenuated Ethiopian fauna of Abyssinia, Eritrea and Somaliland lies within the present sphere of military operations.

The object of the present work is to bring all these species together in one key. Table I is a complete list of these species and shows their distribution as far as it is known at present.

NOTES ON THE STRUCTURE OF MOSQUITOES.

Full descriptions of the structure of mosquitoes are given in the works quoted above and in Barraud, P. J. (1939), "A Practical Entomological Course for Students of Malariology." Health Bull. No. 18, Malaria Bureau, No. 9 Delhi.

The following brief description covers those features which are used to distinguish species in the key.

The *head* (fig. 1) bears the proboscis, a pair of palps and a pair of antennæ. The *palps* are of considerable importance in distinguishing species, the relative lengths of the joints and the distribution of light and dark bands varying considerably. The palps have actually five joints but the first one is rudimentary and the palps appear to be four-jointed. Another important feature of the head is the *frontal tuft* a group of elongated scales, usually white in colour, situated on top of the head and projecting forward between the eyes.

The *thorax* (fig. 2) is composed of three segments, the pro-, meso-, and meta-thorax, each segment being made up of several plates of which the one covering the dorsal surface is known as the notum. The greater part

of the dorsal aspect of the thorax is taken up by the *mesonotum* behind which is a small plate, the *scutellum*. The pronotum is scarcely visible from above and the *metanotum* is a small plate behind the scutellum. The mesothorax bears a pair of wings, the metathorax a pair of knobbed projections, the halteres, which represent the vestiges of a second pair of wings, and all three segments bear a pair of legs.

The wings are stiffened with a series of thickenings known as *veins*. The thickening along the forward margin of the wing is the *costa* and immediately behind it lies the *subcosta*, a vein running from the base to a point near the middle of the wing where it fuses with the costa. Behind the costa and subcosta are six longitudinal veins, commonly numbered serially from the front. The 1st, 3rd, and 6th veins are simple, the 2nd, 4th and 5th are branched towards the extremities. There are several short *cross-veins* between the longitudinal veins and, though their relative position is sometimes used to distinguish species, this character has not been employed in the present key. The veins are covered with scales which, by reason of aggregation or occurrence in patches alternately light or dark in colour, form patterns of considerable importance in distinguishing species. There is a fringe of hairs around the hind margin of the wing. Groups of these hairs, usually opposite the termination of a vein, lighter in colour than the rest, stand out as distinct spots—the *fringe spots* (figs. 11, 13, 14).

The *legs* (fig. 2) consist of a long *femur*, a long *tibia* and a five-jointed *tarsus* of which the first joint is as long as the tibia and the remainder progressively shorter. Arrangements of light and dark scales on the legs also provide characters much used to differentiate species.

NOMENCLATURE.

The names used are those given by the authorities quoted above. Synonyms are given where they are likely to be as familiar as or more familiar than the correct name.

KILLING AND MOUNTING.

Mosquitoes may be killed by tobacco smoke, cyanide, ethyl acetate or chloroform; useful killing bottles may be made by pouring ethyl acetate on to celluloid chips or chloroform on to chopped-up rubber. A little tissue paper should be used to prevent contact between the specimens and the celluloid or rubber.

It is usually recommended that mosquitoes be mounted on a pin run through the thorax from below. This, however, is likely to rub off the scales and hairs on the metanotum, and these hairs and scales are of some systematic importance. This damage may be obviated if the mosquito be impaled on a pin run through the side of the thorax. This technique should not be used for Culicines as the separation of many genera is based on characters on the side of the thorax.

KEY TO SPECIES.

1. At least four alternating light and dark bands along the fore margin of the wing (fig. 3a) 13
Fore margin of the wing uniformly dark or with fewer than four alternating light and dark bands (fig. 3b) 2
2. Dark scales only on wings 3
Light and dark scales on wings 11
3. Dark scales congregated in places to form dark spots, visible to the naked eye (fig. 3b) 4
Dark scales uniformly distributed 5
4. Near the tip of the wing a group of fringing hairs are light in colour and form a distinct spot (fig. 4a); dark spots on wing conspicuous
maculipennis
Throughout Europe and the Mediterranean region the species is divided into biological races which are only distinguishable in the egg stage, some races are serious vectors of malaria, others not; the vectors tend to breed in coastal regions in slightly saline pools, marshes, ditches, etc.
Fringing hairs of wing uniform in colour (fig. 4b); dark spots on wing less conspicuous *elutus*
Eastern Mediterranean; breeds in coastal marshes, etc., known to be a bad vector in Balkans and Palestine.
5. Upper surface of thorax unicolorous; white frontal tuft on head poorly developed 6
Upper surface of thorax light with longitudinal darker stripes; white frontal tuft on head well developed 8
6. Hairs on thorax pale; branching of fourth wing vein nearer body than branching of second vein (fig. 5a) *apoci*
Only recorded from Persian Gulf; relation to malaria unknown.
Hairs on thorax red-brown or dark brown; branching of fourth wing vein further from body than branching of second vein (fig. 5b) 7
7. Scales on top of head narrow *algeriensis*
Mediterranean region and a few places in N. Europe; breeds in marshes; probably not important as a vector.
Scales on top of head broad *habibi*
Only known from Quetta; relation to malaria unknown.
8. Proboscis of female uniformly brown 9
Proboscis of female brown with the tip distinctly lighter brown 10
9. Larger brownish species (wings 5½ to 6 mm. long); last joint of female palp less than half as long as the penultimate *claviger (bifurcatus)*
Europe and the Mediterranean region; breeds in pools and larger bodies of water, usually where there is shade; in general unimportant as a vector though specimens breeding in wells and underground cisterns in towns may maintain a high rate of malaria (e.g. formerly in Jerusalem).
Smaller blackish species (wings 5 mm. long); last joint of female palp more than half as long as the penultimate *plumbeus (nigripes)*
Europe, Asia minor, Caucasus, wherever there are deciduous trees; breeds only in water-filled cavities in trees; can transmit malaria but is probably unimportant as a vector.
10. Upper surface of thorax dark at sides with a broad lighter median stripe *marteri*
Only recorded from Algeria and Bulgaria; breeds in hill streams; relation to malaria unknown.

6 A Key to the Anopheline Mosquitoes of the Mediterranean Region

- Upper surface of thorax greyish yellow with a narrow longitudinal dark stripe and two similar stripes on either side of it *sogdianus*
 Only recorded from Caucasus region; breeds in hill streams; relation to malaria unknown.
11. Last joint of hind tarsus dark (costa, subcosta and 1st vein with scales darker than those on the remaining veins, and with two somewhat obscure white bands near the centre of the wings) *rupicolus (aegypti)*
 Sudan and Sinai; relation to malaria unknown.
 Last joint of hind tarsus white 12
12. Last two joints of tarsus of hind leg white *mauritanus*
 An African species, of which the range extends to Egypt, Palestine and Syria; breeds in large pools and at the edges of larger bodies of water; unimportant as a vector.
 Last joint of tarsus of hind leg white *hyrcanus (pseudopictus, sinensis)*
 Throughout the Mediterranean region and in Asia; breeds in marshes, rice fields, etc.; of minor importance as a vector.
13. Last joint of tarsus of hind leg white 14
 Last joint of tarsus of hind leg dark 17
14. Abdominal segments with a tuft of erect scales at the distal corners (fig. 6) 15
 Abdomen with few scales, none erect 16
15. Distal half of 2nd and whole of 3rd, 4th, and 5th tarsal joints of hind leg white; femora and tibiae slightly speckled, a longitudinal white line terminating in an oval spot on mid and hind femora *pulcherrimus*
 N. India, Mesopotamia, Palestine; breeds in marshes and is, for example, very abundant in the middle marshy reaches of the Tigris and Euphrates; though a bold feeder attacking man viciously both by day and night, it appears to be unimportant as a vector.
 Only 5th segment of hind tarsus wholly white, remainder with broad white apical bands; femora and tibiae spotted with irregular patches of white scales (cf. fig. 7) *pharoensis*
 An African species extending into Egypt and Palestine; breeds in swamps and rice fields, vegetation being apparently an essential feature of the environment; responsible for malaria in the Nile delta.
16. Femora, tibiae and 1st tarsal segments speckled; tarsal joints with white apical bands but no white basal bands except sometimes 3rd joint of hind tarsus (fig. 7) *pretoriensis*
 An African species which has been recorded from S. Arabia; breeds in streams and pools often where there is no vegetation or shade; infrequently found in houses and probably of little significance as a vector.
 Femora and tibiae only speckled; white rings of tarsi embracing both bases and apices of adjacent segments *theobaldi*
 An Indian species recorded from E. Arabia; unimportant as a vector.
17. Femora and tibiae speckled (cf. fig. 7) 18
 Femora and tibiae not speckled (the legs may be covered by a mixture of light and dark scales but the light scales are not aggregated to form conspicuous spots) 20
18. Abdomen with tufts of erect scales at the distal corners (cf. fig. 6) *squamosus*
 An African species extending to Abyssinia; breeds in clear water with some vegetation and little or no flow; unimportant as a vector.
 Abdomen without tufts of erect scales at the distal corners 19

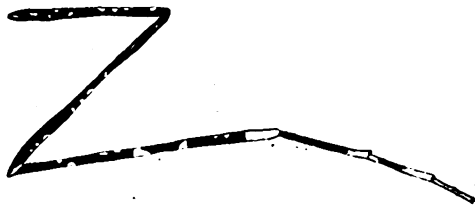
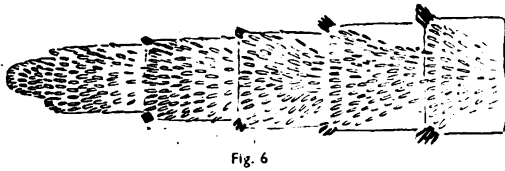
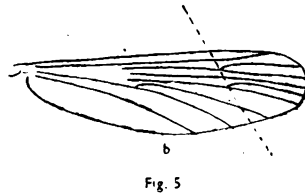
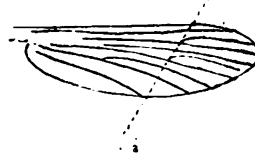
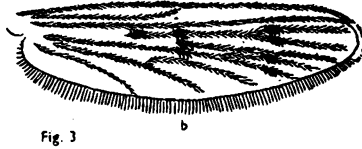
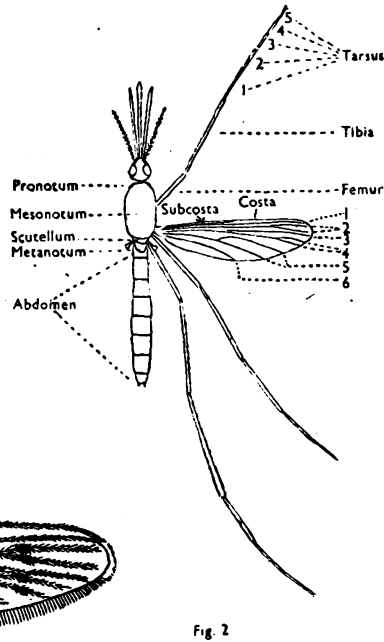
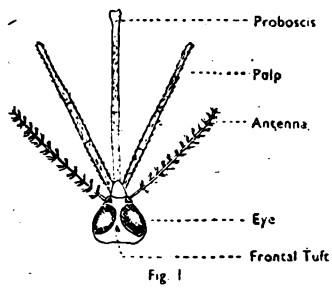


FIG. 1.—Head of female anopheline.
FIG. 2.—Diagram of female anopheles.
FIG. 3.—Wings of (a) *An. gambiae*, (b) *An. maculipennis*.
FIG. 4.—Wing tips of (a) *An. maculipennis*, (b) *An. elutus*.
FIG. 5.—Wings of (a) *An. apoci*, (b) *An. algeriensis*.
FIG. 6.—Abdomen of *A. pharoensis*.
FIG. 7.—Hind leg of *A. pretoriensis*.

8 A Key to the Anopheline Mosquitoes of the Mediterranean Region

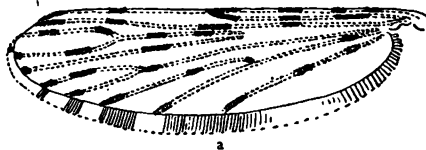
19. Apical and preapical white bands on female palp of roughly equal breadth, basal band narrow, commonly some white spots on the 3rd segment of the palp (fig. 8a); scales, though most abundant towards tip of abdomen, present on all abdominal segments *stephensi*
 An Indian species extending to lower Irak and E. Arabia; breeds in pools in stream beds and irrigation channels; an important vector.
- Apical band of female palp broad, other two narrow, no white spots (fig. 8b); scales only on 7th and 8th abdominal segments *gambiae*
 An African species extending through Abyssinia and Somaliland to S. Arabia; breeds in small localities, e.g. pools, hoof-marks, tins, gutters, etc., often fully exposed to the sun; an important vector.
20. Light scales of wing confined to costal region; female palp with dark tip and two pale bands which may be so obscure that the palp appears unbanded *dhali*
 Mediterranean region excluding Europe and extending through Arabia and Persia into Asia; breeds in a wide variety of habitats; relation to malaria undetermined. Records for *An. rhodesiensis* outside the African region refer to this species.
- Light scales on all the wing veins; female palp with at least three conspicuous white bands 21
21. Tip of female palp dark (fig. 9) 22
 Tip of female palp light (figs. 8, 12) 23
22. Thorax with distinct scales; base of costa light (fig. 10a) *multicolor (chaudoyei)*
 A desert species ranging from the Mediterranean region through Arabia and Persia to Asia; breeds in saline oases; can fly considerable distances (8 miles or more); often responsible for intense malaria in neighbourhood of oases.
- Thorax without scales; base of costa dark (fig. 10b) *turkhudi*
hispaniola
italicus
- These species appear to be indistinguishable in the adult stage; *hispaniola*, western Mediterranean (Spain and N. Africa); *italicus*, Italy; *turkhudi*, E. Arabia, Persia, N. India; breed in small pools, particularly in dried-up stream beds; relation to malaria unknown.
23. Large (length of wing 4.4 to 5.5 mm.) or medium-sized species (*superpictus*, length of wing 3 to 4.7 mm.); female palp with 3 or 4 white bands 24
 Medium-sized (*superpictus*) or small species (length of wing 2.4 to 3.6 mm.); female palp with 3 white bands only 27
24. Abdomen with numerous golden yellow scales; femora and tibiae with a line of white scales along the outer side (female palp with 4 white bands, the terminal band large, the remainder small, confined to the tips of the segments, and sometimes inconspicuous; tarsal joints with white apical bands; length of wing 4.4 to 5.3 mm.) *christyi*
 An African species extending to Abyssinia and Somaliland; breeds in pools, etc., often where conditions are foul and vegetation absent; unimportant as a vector.
- Abdomen without scales; femora and tibiae without longitudinal stripes 25
25. Female palp with 3 white bands, the basal and middle ones small, the apical one large and sometimes divided into two by a narrow dark band so that the palp appears 4-banded; base of costa dark at base (fig. 11a); length of wing 5 to 5.5 mm. *garnhami*



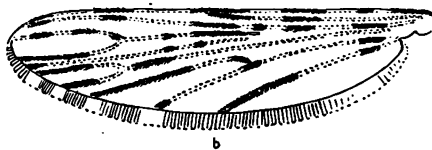
Fig. 8



Fig. 9



a

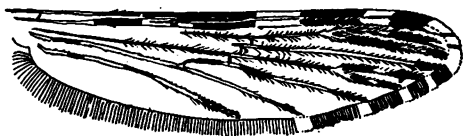


b

Fig. 10



a

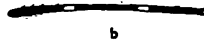


b

Fig. 11



a



b

Fig. 12

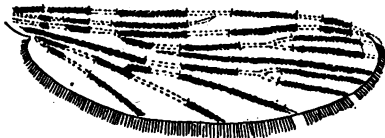


Fig. 13



Fig. 14

- FIG. 8.—Female palps of (a) *An. stephensi*, (b) *An. gambiae*.
 FIG. 9.—Female palp of *An. turkhudi*.
 FIG. 10.—Wings of (a) *An. multicolor*, (b) *An. turkhudi*.
 FIG. 11.—Wings of (a) *An. garnhami*, (b) *An. cinereus*.
 FIG. 12.—Female palps of (a) *An. cinereus*, (b) *An. superpictus*.
 FIG. 13.—Wing of *An. culicifacies*.
 FIG. 14.—Wing of *An. moghulensis*.

10 A Key to the Anopheline Mosquitoes of the Mediterranean Region

- An African species extending to Abyssinia and Somaliland ;
breeds in pools with moderate shade ; unimportant as a vector.
Female palp with 3 or 4 white bands ; base of costa with one or two
white spots (fig. 11b) 26
26. Female palp with 4 white bands, the terminal one being small and
sometimes obscure so that the palp appears three-banded, the
remainder long and embracing both ends of adjacent segments
(fig. 12a) ; length of wing 4.5 to 5 mm. *cinereus*
An African species extending to Abyssinia and S. Arabia ;
breeds in edges of swamps and streams, pools, &c., in shaded or
unshaded situations ; unimportant as a vector.
Female palp with 3 white bands, the terminal one large and some-
times partially or wholly divided by a black band so that the
palp is 4-banded the remainder small (fig. 12b) ; length of wing
3 to 4.7 mm. *superpictus*
North Mediterranean region from Spain to Turkey, extending
through Persia to N. India : breeds almost exclusively in hill
streams ; a serious vector of malaria.
Female palp with 3 white bands, the terminal one large and sometimes
partially or wholly divided by a black band so that the palp is 4-
banded, the remainder small (fig. 12b) ; length of wing 3 to 4.7 mm.
. *superpictus*
North Mediterranean region from Spain to Turkey, extending
through Persia to N. India ; breeds almost exclusively in hill
streams ; a serious vector of malaria.
27. Fringe spots of wing opposite about two veins only (fig. 13) ; (frontal tuft
not well developed ; base of costa with a pale spot, 3rd vein dark
(fig. 13) ; thorax without scales ; legs dark except for occasional
small bands at the tips of the tibiae ; length of wing 2.5 to 3.5 mm.)
. *culicifacies*
- An Indian species extending to E. Arabia and the Persian Gulf ;
breeds usually in clean water, particularly pools in dried-up river
beds ; the most important vector in India.
Fringe spots of wing opposite the termination of most of the wing
veins (cf. figs. 10, 11, 14) 28
28. 4th joint of female palp nearly as long as 3rd ; (frontal tuft well
developed ; base of costa with a pale spot ; vein 3 pale ; legs sometimes
uniformly dark, sometimes with small white bands at the tip of the
tibiae and tarsal joints ; thorax with narrow scales ; length of wing
3 to 4.7 mm.) *superpictus*
See above under 26.
- 4th joint of female palp about half as long as 3rd 29
29. 3rd vein white except for a dark band at either end ; apex of wing
extensively pale (fig. 14) ; femora dark, tibiae and 1st two tarsal
joints of all legs and sometimes 3rd and 4th tarsal joints of hind legs
with narrow but distinct white apical bands ; (frontal tuft well
developed ; base of costa without a pale spot (fig. 14) ; thorax with
narrow scales) *moghulensis*
brousseri
moghulensis, an Indian species extending to Baluchistan ; breeds
in pools in stream beds ; relation to malaria unknown.
brousseri, only known from S. Algeria ; breeds in streams ;
relation to malaria unknown.

3rd vein usually dark (cf. fig. 13); often light in *fluviatilis*; apex of wing not extensively pale; apices of leg joints with at most a tip of white scales.

30. Thorax uniformly coloured; frontal tuft not well developed; (base of costa without a white spot (cf. fig. 11a); white tips to tibiae and femora, tarsi unbanded) *sergenti*

Mediterranean Africa, Palestine, Syria, Persian Gulf, N.W. India; breeds in pools, swamps, etc., often found in freshwater oases; apparently important locally as a vector (e.g. Palestine).

Thorax dark at sides, greyish on top; frontal tuft well developed; (base of costa with or without pale spot; thorax with narrow scales; white tips to tibiae and tarsal joints)

funestus, arabica, fluviatilis (listonii)

These three together with certain other Indian species form a complex of which the members are difficult to distinguish; the difficulty is increased by the fact that there is a certain degree of variation. The chief characters by which these species are distinguished are the relative proportions of the light and dark areas of the palps and various differences in the ornamentation of the wing. Of the three present species *An. fluviatilis* usually has the 3rd vein light, except for some dark spots at the base but occasional specimens with the 3rd vein wholly dark are found. The base of the costa is without a dark spot. In *An. funestus* and *An. arabica* the 3rd vein is dark; *An. funestus* may or may not have a small white spot at the base of the costa while *An. arabica* is distinguished by having a rather broad band in this situation. *An. funestus*: an African species extending to Abyssinia and Somaliland; breeds at sides of large bodies of clear water, e.g. marshy edges of ponds and streams where there is some shade; an extremely important vector.

An. arabica: only recorded from Muscat; little known about its habits and relation to malaria.

An. fluviatilis: an Indian species recorded from the Persian Gulf; breeds in pools in stream beds, in slow flowing weedy rivers and in swampy margins of lakes and ponds; an important vector.

ANTI-SANDFLY SPRAYING WITH LETHANE AND PYRETHRUM.

BY LIEUTENANT-COLONEL W. M. E. ANDERSON, M.D.,

Royal Army Medical Corps.

IN the prevention of diseases which are transmitted by insects much attention is devoted to spraying with solutions which are lethal, or at least repellent, to the vectors. The most important of disease-carrying insects is, of course, the mosquito which transmits malaria, yellow fever, dengue and filariasis, but the Genus *Phlebotomus* (sandfly) is by no means negligible. Besides being the vector of three diseases—sandfly fever, kala azar and oriental sore—the sandfly, an intolerable nuisance as a night feeder, is a major cause of insomnia in tropical regions.

During the hot weather season of 1939, as portion of the work of an Enquiry into Sandfly Fever under the auspices of the Indian Research Fund Association, some experimental work was carried out at Peshawar on the comparative merits of solutions for use as anti-sandfly sprays. The object of the investigation was to determine, as far as possible, (a) the most suitable solution, suitability being assessed by the twin attributes of efficiency and economy and (b) the most satisfactory means of application. With a view to results of practical value, experiments were chiefly centred on the solutions and methods of distribution which were in routine use. At the close of the period the work was far from complete but the outbreak of war prevented its being continued into the following year and such results as were obtained are here recorded.

SOLUTIONS INVESTIGATED.

The following solutions formed the subject of investigation by "biological assay" methods.

(1) *Lethane* (384).—Lethane is an aliphatic thiocyanate manufactured by the firm of Charles Lennig & Co. A preliminary report has been published (Anderson, 1939) of some investigations of the efficacy of this substance against sandflies. A 1/33 solution in kerosene has been in use in Peshawar as an anti-mosquito spray for the past two years.

(2) *Pyrethrum-containing Solutions*.—Five such solutions were investigated, three "kerosene-base" and two "water-base." The "kerosene-base" solutions were as follows:—

(a) *Stafford Allen's Liquid Extract*.—This solution, diluted 1/64 with kerosene, has been used in India over several years by the military medical authorities for anti-mosquito and anti-sandfly purposes. For the sake of brevity, it will be referred to as "Pyefly," the name commonly applied to a 1/64 solution.

(b) *Pyrocide 20*.—This is an American product which is more expensive

than "Pyefly." Diluted 1/20, it has been favourably reported upon for anti-mosquito work by the Malaria Commission of India. The manufacturers state that its effect is enhanced by the addition of 5 per cent of pine oil.

(c) *Pyractone*.—This is produced by Messrs. Stafford, Allen & Co. and described by them as "a kerosene extract of pyrethrum, containing an activator." It is recommended for use diluted 1/40 in kerosene.

Two "water-base" solutions were also the subject of some tests.

(a) *Desquito*.—This is an aqueous pyrethrum extract, manufactured by Messrs. Stafford, Allen & Co. and recommended for use diluted 1/14 with water. Mackie and Crabtree (1938) found this substance to be satisfactory for ridding aircraft of mosquitoes.

(b) *Multicide*.—This is produced by the manufacturers of Pyrocide 20 and is primarily intended as a garden or livestock spray diluted 1/100 to 1/400 with water.

METHODS OF INVESTIGATION.

The sandflies used for these experiments were mostly *P. papatasi* but included also a few specimens of *P. minutus* and other species caught in the vicinity of Peshawar. No attempt was made to confine the experiments to one particular species.

It is extremely difficult to formulate absolute standards by which the potency of solutions can be compared but it appeared reasonable to regard a suitable preparation as having the twofold properties of (a) killing some sandflies outright and (b) exerting a repellent effect on others. Of these the former is more readily assessable but must be regarded as being mainly of academic importance because almost all phlebotomocidal solutions are, to some degree, unpleasant to human beings and to produce, and maintain, in a room at atmospheric concentration actually lethal to sandflies would, if possible at all, be certain to cause considerable discomfort to the human inhabitants. A much lower concentration, not affecting human beings, can be regarded as of definite value if it is effective in reducing the number of sandflies through its repellent action and investigations were therefore directed towards gauging (i) the "lethal value" and (ii) the "repellent value" of the solutions under test.

(i) The lethal value was considered in terms of (a) the "direct effect" and (b) the "indirect effect."

(a) By "direct effect" is implied the effect of spraying the sandflies directly with the liquid in various dilutions. A white towel or sheet was spread on the floor at the base of a whitewashed wall on to which sandflies, five or six at a time, were released from a test-tube and sprayed with the solution from a high pressure coarse spray of the common "Flit-gun" type. It was found that if the vapour was turned directly on the flies, they tended to be blown away by air currents and the practice was to direct the spray above them so that they came into contact with falling droplets and vapour. Of those brought down the majority fell on the sheet where their

behaviour could easily be noted. The phenomena observed consisted, occasionally, of instantaneous death and, more often, of struggling followed by either death or recovery. Both water-base and kerosene-base solutions were tested in this way and, as preliminary observations suggested that a few flies (about 20 to 40 per cent) were killed by water or kerosene alone, in subsequent experiments, unless 100 per cent of flies were killed, the dilution was not regarded as lethal.

(b) The term "indirect effect" was used to record the effect on sandflies of exposure to the vapour produced in measurable atmospheric concentrations by means of a "Phantomyst" nebulizer (Type A.1) which was loaned to the Enquiry by the A.D.M.S. — District (Colonel F. F. Strother Smith, I.M.S.). The nebulizer, containing the solution in measured dilutions, was operated in a closed room of dimensions 15 by 9 by 10½ feet (a capacity of almost 1,420 cubic feet) in which were placed two glass roofed muslin cages of sandflies. The doors and windows of this room were closed but not sealed, as it was desired to reproduce the conditions under which the

Fig. 1 Static arrangement

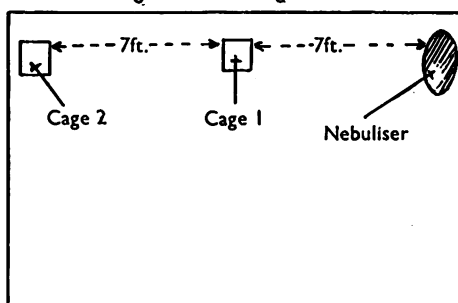
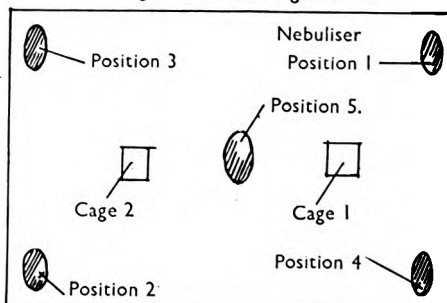


Fig. 2 Mobile arrangement



nebulizer might be used in barracks, etc. The room was in a private bungalow of modern type, with well fitting windows and doors, and the loss of vapour by leakage was probably not more than 5 per cent. In most of the experiments the arrangement of the cages and nebulizer was as shown in fig. 1 and is referred to as the "static arrangement." Cage 1 was on the floor and Cage 2 raised about three feet above the ground. On some occasions, with a view to more even distribution of the vapour, another "layout" (the "mobile arrangement"—fig. 2) was adopted in which the nebulizer was moved into another part of the room every fifteen to twenty minutes. In each experiment the reservoir of the nebulizer was filled with a standard quantity of 2,400 c.c. of solution (about two-thirds of its capacity) and the apparatus was operated continuously until either the flies were killed or, after three to five hours, it was considered that the solution was unlikely to have any effect. Death was distinguished from temporary stupefaction by removing the cage to the fresh air and watching for signs of revival. In these experiments this never occurred. The cages were observed at intervals of fifteen to twenty minutes at first and, when the flies appeared

sluggish, they were inspected every ten minutes. Entry to the room was through double doors which precluded more than a slight loss of vapour. At the end of the experiment the reservoir was drained and the amount of solution was calculated. The number of cubic centimetres of undiluted solution per 1,000 cubic feet of room space is referred to as the "lethal concentration" and, to determine this, two formulæ were devised. If a nebulizer is available which consumes a constant quantity of solution in one hour, the concentration may be found from

$$\frac{V \times P \times T}{6 R} = \text{Lethal concentration}$$

V = number of centimetres consumed in one hour.

P = percentage strength of solution used.

T = minutes for which nebulizer was working.

R = capacity of the room in cubic feet.

The consumption of this nebulizer varied very considerably and it was necessary to measure the actual amount of solution used in each experiment (expressed by the symbol U). This formula was then used

$$\frac{10 (U \times P)}{R} = \text{Lethal concentration.}$$

In experiments where there was a considerable difference in the times required to kill the flies in each of the two cages the number of minutes in respect of the first and second cages was recorded as T1 and T2 respectively and the atmospheric concentration at the time the first cageful of flies died

was taken as $\frac{T1}{T2} \times \frac{10(U \times P)}{R}$.

The work was carried out on fine afternoons and evenings during the hot weather months of June to mid-September and variations in meteorological conditions were very slight.

(ii) The "repellent effect" was investigated by spraying a room with the solution under test and noting to what extent, and for what period, the sandfly population was reduced. An index to the number of flies in a room was obtained by having them collected in test tubes by specially trained sepoys over a period of one hour in the evening, about dusk, or in the morning, as soon as possible after sunrise, a process which is referred to as "surveying." This was a rough and ready method, introducing a very great personal element which could only be minimized by careful supervision of the collectors and strict adherence to the time table.

Two large barrack rooms, each of about 20,000 cubic feet capacity, and similar in shape, were used as "Test" and "Control" rooms and the routine of each experiment was as follows—

Day 1. Morning, 6.30 to 7.30 a.m. (later 7 to 8 a.m.) Survey, both rooms.

Evening, 8 to 9 p.m. (later 7.30 to 8.30 p.m.) Survey, both rooms.

Day 2. Morning, 6.30 to 8 a.m., Spraying, test room.

Evening, as on Day 1.

Day 3 (and subsequent days if necessary), as on Day 1.

Four sandfly collectors were employed in each room. The first day's work gave some idea of the testing state of the rooms and a comparison of the numbers of sandflies caught in the two rooms, before and after the spraying, indicated the extent of the reduction.

A large electrically driven Phantomyst (Type D) was used for these experiments but proved disappointing in that the amount of solution consumed was much lower than had been expected and also varied considerably. In four experiments the hourly consumption was 80, 66, 26 and 100 c.c. respectively. This meant that the atmospheric concentration at the end of the period was very low but spraying could not be prolonged as it was not feasible to exclude the occupants of the test room from their quarters for a longer period than one and a half hours.

Two similar experiments were also carried out in which the solution was distributed by four men, equipped with Flit guns, working for approximately ten minutes and paying particular attention to possible sheltering places of adult sandflies, such as cracks in masonry, underneath kit-boxes and behind articles of equipment hanging from pegs. Before commencing, a measured quantity of solution was placed in the reservoir of each gun and, at the conclusion, the residue was pipetted off and measured and the amount used determined. Throughout these experiments the weather was consistently fine and dry and probably had a negligible effect on the results.

Finally, as the trend of the work suggested that none of the solutions tested exerted a repellent action for much longer than twelve hours, experiments were carried out to investigate the efficacy of daily spraying and, with a view to economy, solutions of Lethane and Pyefly, weaker than those in routine use, were employed. The results are later reported in detail and suggested that good results follow daily spraying and that appreciably weaker solutions may be used.

The results of tests applied to each solution are described below.

(1) KEROSENE-BASE INSECTICIDES.

(a) *Lethane*.—On direct contact, Lethane killed sandflies in a dilution of 1/100.

Its indirect effect was investigated in five experiments (Table I). In this and similar tables the "lethal concentration" is expressed in cubic centimetres of pure solution per 1,000 cubic feet.

TABLE I.—LETHANE, INDIRECT LETHAL EFFECT. (STATIC ARRANGEMENT.)

No.	Dilution	Lethal concentration		Mean
		Cage 1	Cage 2	
1	1/10	7.4	7.4	7.4
2	1/10	6.5	7.0	6.75
3	1/12	7.32	6.3	6.81
4	1/16	7.2	7.2	7.2
5	1/33	7.4	7.4	7.4

If allowance is made for slight meteorological differences and for a, presumably, varying vitality among sandflies the results were reasonably constant and suggested that the lethal concentration of Lethane is in the region of 7 to 7.4 c.c. of pure solution per 1,000 cubic feet of air space. This concentration renders a room unpleasant to humans.

Two experiments were performed to investigate the repellent effect. For the first the Phantomyst was used and consumed 120 c.c. of 1/10 Lethane in ninety minutes, producing a concentration equivalent to 0.6 c.c. of undiluted solution per 1,000 cubic feet. The numbers of flies caught in the two rooms during the experiment are shown in Table II. In this and subsequent

TABLE II.—LETHANE, REPELLENT EFFECT. (DISTRIBUTION BY PHANTOMYST.)

Day	Time	Flies caught in each room		Test/Control percentage
		Test	Control	
1	a.m.	78	32	238
	p.m.	58	33	176
2	a.m.	Spraying, test room		
	p.m.	15	36	42
3	a.m.	56	31	181
	p.m.	56	45	124

tables, in the final column, the test room catch is expressed as a percentage of that in the control room, providing an indication of the reduction in sandfly population.

In the second experiment (Table III) the Lethane in 1/33 solution was

TABLE III.—LETHANE, REPELLENT EFFECT. (DISTRIBUTION BY FLIT GUNS.)

Day	Time	Flies caught in each room		Test/Control percentage
		Test	Control	
1	a.m.	64	53	120
	p.m.	55	41	124
2	a.m.	Spraying, test room		
	p.m.	20	42	47
3	a.m.	89	46	193
	p.m.	52	49	85

distributed in the test room by four men with hand sprays over a period of ten minutes (7.20 to 7.30 a.m.) 480 c.c. of solution were used, giving a concentration equivalent to 0.7 c.c. per 1,000 cubic feet.

These experiments suggested that a definite reduction in the sandfly population of a room was demonstrable after twelve hours, but not after twenty-four, by a concentration of Lethane between 0.6 and 0.7 c.c. per 1,000 cubic feet, an amount which was hardly perceptible by human beings.

(b) Pyrethrum-containing preparations (Pyefly, Pyrocide 20 and Pyrac-tone).

(i) *Pyefly*.—On direct contact this preparation killed sandflies in a dilution of 1/200.

In investigating the indirect effect it was early evident that the lethal concentration appeared to vary considerably with different dilutions. Table IV shows the results of nine experiments with five different dilutions, using both the "static" and "mobile" arrangements of the cages and nebulizer.

TABLE IV.—PYEFLY, INDIRECT LETHAL EFFECT.

No.	Dilution	Arrangement	Lethal concentration		Mean
			Cage 1	Cage 2	
1	1/100	Static	1.26	1.14	1.20
2	1/100	Mobile	1.49	1.76	1.62
3	1/75	Static	0.98	0.81	0.89
4	1/50	Static	1.63	2.11	1.87
5	1/50	Mobile	3.8	3.74	3.77
6	1/33	Static	1.92	2.95	2.43
7	1/33	Mobile	2.67	2.95	2.81
8	1/25	Static	3.94	3.26	3.60
9	1/25	Mobile	4.22	3.77	3.94

No explanation can be given for these widely varying results. Extraneous factors were, as far as possible, reduced to a minimum, i.e. the concentrated extract was from a recently delivered supply and was stored in its original container and only withdrawn immediately before making up the solution, for which only first grade kerosene was used. It would appear that, in the vapour evolved by the Phantomyst nebulizer, pyrethrum and kerosene were not present in the same proportions as in the solution but there were no facilities for checking this by chemical estimations before and after each experiment.

Two experiments were performed to investigate the repellent effect. In the first (Table V) the Pyefly, diluted 1/75, was distributed by the Phantomyst which used 100 c.c. of solution, producing an atmospheric concentration of 0.06 c.c. per 1,000 cubic feet.

TABLE V.—PYEFLY, REPELLENT EFFECT. (DISTRIBUTION BY PHANTOMYST.)

Day	Time	Flies caught in each room		Test/Control percentage
		Test	Control	
1	a.m.	75	53	139
	p.m.	65	63	103
2	a.m.	Spraying, test room		
	p.m.			
3	a.m.	25	41	61
	p.m.	64	49	128
		61	49	122

In the second experiment (Table VI) the Pyefly, in 1/75 dilution, was distributed by four men with hand sprays; 430 c.c. of solution were used, producing a concentration of about 0.28 c.c. per 1,000 cubic feet.

TABLE VI.—PYEFLY, REPELLENT EFFECT. (DISTRIBUTION BY FLIT GUNS.)

Day	Time	Flies caught in each room		Test/Control percentage
		Test	Control	
1	a.m.	52	65	79
	p.m.	46	53	87
2	a.m.	Spraying, test room		
	p.m.			
3	a.m.	25	36	69
	p.m.	70	45	79
		45	78	58

These two experiments suggested that Pyefly will produce a diminution in the numbers of sandflies in a room for up to twelve hours after spraying. The diminution was rather less marked than when Lethane was used.

Except in high concentrations (2.5 c.c. per 1,000 cubic feet, or more) Pyefly was not unpleasant to human beings.

(ii) *Pyrocide 20*.—Made up with the addition of one part of pine oil to nineteen of the *Pyrocide 20*-kerosene mixture (as recommended by the manufacturers), this substance was found to kill sandflies directly in a dilution of 1/100.

Three experiments (Table VII) were carried out to investigate the indirect effect. In the first two of these 5 per cent of pine oil was added to the solution of *Pyrocide 20* in kerosene and the lethal concentration appeared to be considerably lower than when, in the third experiment, pine oil was not used.

TABLE VII.—PYROCIDE 20, INDIRECT LETHAL EFFECT.

No.	Dilution	Lethal concentration		Mean
		Cage 1	Cage 2	
*1	1/20	1.8	1.6	1.7
*2	1/33	1.3	1.24	1.27
3	1/20	2.6	2.5	2.55

* 5 per cent. of pine oil added to the *Pyrocide 20* solution.

These few experiments tended to substantiate the claim that the action of *Pyrocide 20* is enhanced by the addition of pine oil. In these concentrations the vapour from *Pyrocide 20* was quite pleasant to humans.

One experiment (Table VIII) was performed to investigate the repellent effect, using a 1/20 solution in kerosene with 5 per cent pine oil added. The *Phantomyst* utilized only 40 c.c. of solution, producing an atmospheric concentration of 0.1 c.c. per 1,000 cubic feet. The repellent effect appeared to last not longer than twelve hours.

TABLE VIII.—PYROCIDE 20, REPELLENT EFFECT. (DISTRIBUTION BY PHANTOMYST.)

Day	Time	Flies caught in each room		Test/Control percentage
		Test	Control	
1	a.m.	57	59	97
	p.m.	56	63	89
2	a.m.	Spraying, test room		
	p.m.			
3	a.m.	38	76	50
	p.m.	77	70	110
3	a.m.	71	89	80
	p.m.			

(iii) *Pyractone*.—Only a very small quantity of this substance was available and it was not possible to investigate the repellent effect.

On direct contact it was found to kill sandflies in a dilution of 1/200.

Four experiments (Table IX) were carried out to investigate the indirect effect. Owing to the small amount of *Pyractone* available for these experiments the residual solution had to be re-used. The results show considerably less variation than in the *Pyefly* experiments, and it is possible that *Pyractone* might be more satisfactory for general use. In moderate concentrations *Pyractone* had quite a pleasant smell.

TABLE IX.—PYRACTONE, INDIRECT LETHAL EFFECT.

No.	Dilution	Lethal concentration		Mean
		Cage 1	Cage 2	
1	1/25	2.11	2.11	2.11
2	1/25	1.59	1.69	1.64
3	1/40	1.6	1.24	1.42
4	1/66	1.51	1.79	1.65

THE ADDITION OF PINE OIL AND NAPHTHALENE TO PYEFLY.

As pine oil appeared to enhance the insecticidal power of Pyroside 20, some investigations were made as to whether the effectiveness of Pyefly could be increased by adding pine oil and also naphthalene. Preliminary experiments indicated that solutions of naphthalene to kerosene, varying from 6 per cent to 10 per cent, were not lethal either directly or indirectly. It was also found that when 5 per cent pine oil was added to 1/100 Pyefly, sandflies were killed directly by the solution diluted up to three times (i.e. about 1/300 Pyefly) and indirectly by an atmospheric concentration of 1.32 c.c. of Pyefly (and 6.63 c.c. of pine oil) per 1,000 cubic feet.

A solution was then prepared containing one part of Pyefly in seventy-four parts of 8 per cent naphthalene to kerosene to which was added one-twentieth volume of pine oil.

On direct contact sandflies were killed by the solution diluted four times, i.e. about 1/300 Pyefly, as compared with 1/200 without adjuvants.

The solution also killed sandflies indirectly in an atmospheric concentration of 0.75 c.c. of Pyefly per 1,000 cubic feet which was lower than the lowest figure noted for Pyefly alone.

In a repellent experiment (Table X), 150 c.c. of solution were consumed by the Phantomyst, producing a concentration of Pyefly of 0.091 c.c. per 1,000 cubic feet.

TABLE X.—PYEFLY, WITH ADDITION OF NAPHTHALENE AND PINE OIL ; REPELLENT EFFECT (DISTRIBUTION BY PHANTOMYST.)

Day	Time	Test	Flies caught in each room Control	Test/Control percentage
1 {	a.m.	72	70	104
	p.m.	42	56	75
2 {	a.m.		<i>Spraying, test room</i>	
	p.m.	40	91	44
3 {	a.m.	66	69	88
	p.m.	68	42	168

The figures suggest some repellent effect after twelve hours but not after twenty-four. There was no definite evidence of an increased repellent effect through the addition of pine oil and naphthalene.

SUMMARY OF OBSERVATIONS ON KEROSENE-BASE PYRETHRUM SOLUTIONS.

Pyrethrum in kerosene was found to kill sandflies, both directly and indirectly, in very low concentrations of all the three preparations tested. The theoretical lethal concentrations of these solutions appeared to vary very considerably and for this no satisfactory explanation can be given. The lethal effect of pyrethrum appears to be increased by the addition of small amounts of pine oil and also, possibly, of naphthalene. The repellent effect of pyrethrum, as tested by the methods in use at Peshawar, appeared to be still appreciable after twelve hours but not after twenty-four and it would therefore seem that spraying, to be effective, should really be carried out twice daily. Since, however, the sandfly is nocturnal in its habits, spraying

once daily, in the evening at dusk, would probably be sufficient if carried out in a thorough and intelligent manner.

WATER-BASE INSECTICIDES.

(a) *Desquito*.—Diluted 1/14 with water, this solution killed sandflies on direct contact.

Two experiments were performed to investigate the indirect effect. Using a 1/14 solution, the flies were unaffected at the end of three hours in an atmospheric concentration of 10.34 c.c. per 1,000 cubic feet. A 1/10 dilution was then used but, after five hours, with an atmospheric concentration of 18.31 c.c. per 1,000 cubic feet, the majority of the flies in both cages were still alive.

(b) *Multicide*.—Only a very small quantity of this product was available. In a dilution of 1/100 in water it failed to kill sandflies on direct contact. In an "indirect effect" experiment, with a 1/100 solution, the flies were unaffected at the end of four hours in an atmospheric concentration of 1.48 c.c. per 1,000 cubic feet.

These experiments with *Desquito* and *Multicide* gave inconclusive results but it is possible that a low pressure apparatus, such as the *Phantomyst*, is not an ideal means of distributing a watery solution. It was not possible to investigate the repellent effect of *Desquito* and *Multicide*.

Table XI shows, in tabular form, a summary of the direct and indirect effect experiments with kerosene-base and water-base solutions. In the repellent experiments, none of the solutions tested appeared to be effective for more than twelve hours.

TABLE XI.—SUMMARY OF RESULTS, "DIRECT" AND "INDIRECT" EFFECT EXPERIMENTS.

Preparation				Normal dilution	Direct effect (lowest dilution killing on contact)	Indirect effect (minimum lethal concentration, c.c. per 1,000 cubic ft.)
Lethane	..	..	..	1/33	1/100	6.75—7.4
Pyefly :						
(a) alone	..	..	..	1/64	1/200	0.89—3.94
(b) with pine oil	..	..	..	—	1/300	1.32
(c) with pine oil and naphthalene	..	..	..	—	1/300	0.75
Pyroicide 20 :						
(a) alone	..	..	..	—	—	2.55
(b) with pine oil	..	..	..	1/20	1/100	1.27—1.7
Pyractone	..	..	..	1/40	1/200	1.42—2.11
Desquito	..	..	..	1/14	1/14 (or weaker)	? (more than 18.31)
Multicide	..	..	..	1/100	? (stronger than 1/100)	? (more than 1.48)

("Normal dilution" refers either to the dilution recommended by the manufacturers or that in routine use at the time of these investigations.)

THE DAILY SPRAYING OF BARRACK ROOMS.

The work to date had suggested that the repellent action of the solutions in general use was hardly appreciable after twelve hours and, towards

the end of the hot weather, two experiments were performed to investigate the effect of daily spraying with Lethane and Pyefly. For these experiments two barrack rooms, each of 18,000 cubic feet capacity, were used as test and control and work was on the following routine:—

Day 1. Morning:—Survey, both rooms. Evening:—first spraying.

Day 2. Morning:—Survey, both rooms. Evening:—second spraying.

Day 3. Morning:—Survey, both rooms.

The morning surveys were carried out by three men in each room over one hour (7 to 8 a.m.) and the evening spraying of the Test room by three men with Flit guns over ten minutes (6.30 to 6.40 p.m.). For the first spraying the solution was that in routine use and, for the second, one considerably more dilute with the idea that it might be possible to effect some economy through the use of weaker solutions. It was also hoped to simulate the condition of a room in which traces of the solution were present from repeated daily sprayings with weak solution and it was considered that this might be produced by the use of the stronger solution for the first spraying.

For the first experiment (Table XII) Lethane was used.

TABLE XII.—DAILY SPRAYING, LETHANE.

Day	Time	Flies caught in each room		Test/Control percentage
		Test	Control	
1	a.m.	75	60	125
	p.m.	Spraying, test room—1/33 Lethane		
2	a.m.	12	53	23
	p.m.	Spraying, test room—1/66 Lethane		
3	a.m.	15	53	29

The atmospheric concentrations of Lethane after the two sprayings were 0.58 and 0.28 c.c. respectively. The experiment suggested that spraying with 1/66 Lethane in a room in which traces of the solution were already present would produce an appreciable reduction (in this case nearly 80 per cent) in the numbers of sandflies present twelve hours later.

Using Pyefly, a second experiment was carried out (Table XIII).

TABLE XIII.—DAILY SPRAYING, PYEFLY.

Day	Time	Flies caught in each room		Test/Control percentage
		Test	Control	
1	a.m.	28	19	148
	p.m.	Spraying, test room—1/75 Pyefly		
2	a.m.	4	16	25
	p.m.	Spraying, test room—1/100 Pyefly		
3	a.m.	3	16	19

The atmospheric concentrations produced were 0.27 and 0.2 c.c. per 1,000 cubic feet respectively. At the time of this experiment the weather was becoming cooler (a fact which is reflected in the small number of flies caught in the control room) and the figures noted (83 and 87 per cent) may not exactly represent what the reduction would be at a warmer time of year. The experiment suggested, however, that a marked reduction follows the

spraying, at dusk, with 1/100 Pyefly, of a room in which traces of solution are already present.

These experiments were encouraging in that they suggested that daily spraying with weak solutions produces good results. Further investigation along these lines would be very welcome.

THE OUTPUT OF A FLIT GUN.

As in practice it is not feasible to measure the contents of the reservoir of a Flit gun before and after use, an effort was made to ascertain the output of these appliances. Guns under test were filled with plain kerosene and were operated in an intermittent manner (to represent normal usage) over a measured time and the amount of kerosene used was determined. In nine experiments, by three operators with three guns, there was a variation of 11 to 23 c.c. per minute and, for practical purposes, a theoretic output of 12 c.c. per minute is suggested, as allowing a reasonable margin for personal variation.

COMPARATIVE EFFICIENCY OF PHANTOMYST AND FLIT GUNS.

Both these appliances varied greatly in their mean output and, while the nebulizer requires less labour and is probably more satisfactory for purely experimental purposes, it must be remembered that it is an extremely expensive apparatus with appreciable running costs and an oft-recurring problem of repairs and spare parts, all of which outweigh its slight advantages over the Flit gun for everyday use. In fact, if the gun be used in a thorough and intelligent manner, these observations suggest that it will give equally good results. If spraying is to be carried out daily the increased cost of solution makes it essential that expenditure on distributing apparatus should be kept to a minimum and the purchase of costly appliances, such as the Phantomyst, would appear to be unwarranted.

ESTIMATION OF DOSAGE FOR SPRAYING ROOMS.

As a practical application of this work, the following are tentatively suggested as a guide to dosage in the spraying of rooms:—

- (1) Spraying should be carried out daily, at dusk.
- (2) Solutions of 1/66 Lethane, or 1/100 Pyefly, should be used. Third grade kerosene appeared to be a satisfactory base, except for use in private bungalows where it may cause soiling of curtains or coverings.
- (3) If Flit guns are used, for each 600 cubic feet of room space, spraying should be carried out for one minute with one gun.
- (4) If a Phantomyst nebulizer be used, the approximate consumption of solution in cubic centimetres per minute should be determined from at least three preliminary trials, using plain third grade kerosene (this volume is denoted as "V"). The room should then be sprayed for $\frac{20}{V}$ minutes for every 1,000 cubic feet. With either of the two types of Phantomyst used in these experiments this is likely to be a lengthy operation.

SUMMARY.

(1) Lethane provides an efficient spraying solution for anti-sandfly purposes.

(2) Pyrethrum preparations are also very satisfactory and their potency appears to be increased by the addition of pine oil. There is some uncertainty about dosage.

(3) Daily spraying of rooms is essential.

(4) For practical purposes, Flit guns appear to give results equally as good as the Phantomyst nebulizer.

(N.B.—In 1939, Lethane was cheaper than any of the Pyrethrum preparations but prices may have altered since the outbreak of war.)

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ESTIMATION OF SULPHONAMIDE COMPOUNDS IN BLOOD BY THE LOVIBOND COMPARATOR.

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WITH the extensive use of sulphonamides, a convenient method of estimating the blood concentration of the drugs is necessary. At low concentration they may be ineffective ; at high, they may produce harmful effects. Particularly necessary is a fairly accurate and simple means of estimation, for use in field hospitals. Two bedside methods have been described, both involving the conversion of the sulphonamide into a pink dye. Schoeffel (1940) matches the colour of a filter-paper strip saturated with the dye against strips similarly treated with standard solutions. The accuracy of this method is difficult to assess on the published data. In the method of Ratish and Bullowa (1940) sulphapyridine is extracted from blood by ether and converted into a pink dye by Marshall's method (1937) ; the pink dye is matched against standard phenol-red solutions, the results being 75 to 95 per cent of those obtained by simultaneous photometer determinations. There was no statement of the suitability of this method for other sulphonamides. More recently, a method based upon the use of the Lovibond comparator has been introduced. The compactness and simplicity of the comparator would be of advantage to field hospitals. So far no data on its reliability have appeared.

The aim of the present investigation was to assess the accuracy of the comparator by making simultaneous determinations of sulphonamides in the comparator and colorimeter.

METHOD

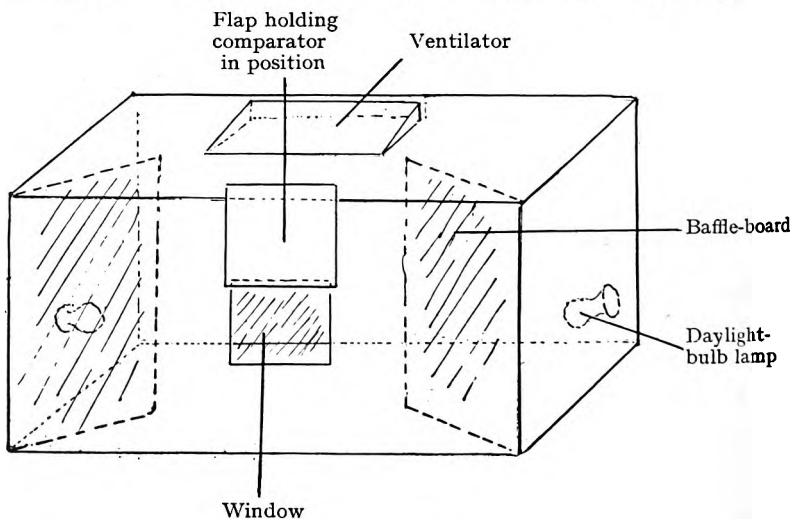
The principle of the comparator method is the matching against coloured glass standards of the pink dye formed on coupling diazotized sulphanilamide with an amine, according to Bratton and Marshall's procedure (Bratton and Marshall, 1939). The intensity of the colour is proportional to the concentration of sulphanilamide, and each glass standard corresponds to a known amount of sulphanilamide. The method has been used for estimating total and free blood sulphanilamide and total and free blood sulphapyridine. Sulphapyridine is estimated as sulphanilamide and the result is multiplied by the appropriate correction-factor. The factor 1.4 for sulphapyridine was used during this investigation.

The comparator consists of a bakelite case with a hinged lid, into the back of which the disc with nine glass colour standards is fitted. At the back of the case are two slots for test tubes containing the liquids under examination.

Light is transmitted through an opal screen posteriorly and the tubes are viewed through two holes in the lid. The value of the colour standards appears on the front of the disc through an indicator recess in the bottom right-hand

corner of the lid as the disc is rotated. The standard sulphanilamide disc covers the range 0.5 to 8.0 mgm./100 c.c., in nine steps. Owing to the brightness of the test solution, a yellow "brightness screen" is used in front of the right-hand lid-aperture. The pink test solution is poured into the test-tube in the right-hand slot. That in the left-hand slot contains a "blank" solution, made up with each fresh batch of reagents by substituting 2 c.c. of water for blood. The disc is rotated until a match is reached and the value of the blood sulphanilamide in mgm./100 c.c. is read off at the indicator-recess. Values of less than 1 mgm./100 c.c. are approximated by eye. With practice, readings may be made to 0.25 mgm./100 c.c.

When matching the test solutions, the comparator must be held up to a uniform source of white light, a north window where possible. During the present investigation, a viewing box giving constant illumination has been used. The box is painted white inside, and contains two daylight-bulb lamps; the comparator fits into a square window in one wall of the box. A diagram of the viewing-box is



given but a simpler one could be improvised. A viewing-box is essential unless estimations are made during daylight. Constant illumination was found during the present investigation to be extremely important.

The comparator weighs approximately 9 oz. Its dimensions are $3\frac{3}{4}'' \times 3\frac{3}{4}'' \times 1\frac{1}{2}''$. It may be obtained from the Tintometer, Ltd., The Colour Laboratory, Milford, Salisbury.

INVESTIGATION OF ACCURACY

The accuracy of the comparator method of sulphonamide estimation was studied. Estimations were made in parallel by different observers using (a) the comparator method and (b) a modification of Marshall's method (Marshall, 1937), with a plunger-type colorimeter, and the results obtained by the two methods were compared.

Parallel estimations were made on aqueous solutions containing amounts of sulphanilamide of the order of the concentrations usually found in blood of patients and on blood samples from patients under treatment with sulphanilamide and sulphapyridine. The results are shown in the tables.

TABLE I.—ESTIMATION OF AQUEOUS SOLUTIONS OF SULPHANILAMIDE BY COMPARATOR AND COLORIMETER.

	<i>Mgm./100 c.c. H₂O by weight</i>	<i>Mgm./100 c.c. H₂O fd. by comparator</i>	<i>Mgm./100 c.c. H₂O fd. by colorimeter</i>
A	2.0	1.8	2.0
B	4.0	4.0	3.75
C	1.0	1.0	1.3
D	8.0	8.0	8.6
E	10.0	10.0	10.0
F	9.0	9.0	9.8
G	7.0	7.0	6.7
H	6.0	6.0	5.7
I	5.0	5.0	4.7
J	3.0	3.0	2.65
Q	6.0	6.0	6.0
R	4.5	4.0	4.55
S	2.5	2.2	2.42
T	3.0	3.0	3.3
U	8.0	7.0	7.8
V	10.0	10.0	10.0
W	1.0	1.0	1.2
X	5.0	5.0	5.5
Y	7.5	7.0	7.6
Z	9.0	9.0	8.7

It is seen that the colorimeter method is reasonably accurate; on only two samples out of the 20 does the colorimeter result differ by more than 0.5 mgm./100 c.c. from the known concentration of the sample.

The comparator method is also fairly accurate. In only one of the 20 samples is the result as much as 1 mgm./100 c.c. different from the known concentration. It should be remembered, however, that the comparator standards go in steps of 1 mgm./100 c.c., and the solutions were made up in concentrations of whole numbers of mgm./100 c.c. So the theoretical limits of the accuracy of the comparator would be ± 1 mgm./100 c.c.

110 parallel estimations were made on blood specimens from 16 sulphanilamide-treated patients. The comparator readings were on the whole higher than those of the colorimeter and, in the first 60 analyses, agreement was not very satisfactory. 20 per cent of the results showed a difference of 3 to 4 mgm. These differences were apparently due to the following factors; (a) Lack of a constant source of illumination. This was remedied by the use of the light box giving uniform light for comparator estimations; (b) failure to realize that the standard solutions for the colorimeter must be very close to the unknown in colour; and (c) difficulty in matching colours in comparator. With experience this was overcome.

The last 50 parallel estimations are given in Table II. In 39 determinations (78 per cent) the difference between comparator and colorimeter results was less than 1.5 mgm./100 c.c. The difference in 8 (16 per cent) was 1.5 to 2.5 mgm./100 c.c., and in 3 (6 per cent) it was more than 2.5 mgm./100 c.c.

TABLE II.—ESTIMATIONS OF BLOOD SAMPLES FROM SULPHANILAMIDE-TREATED PATIENTS

T = Total sulphanilamide
F = Free sulphanilamide

Sample	T or F	Result by Comparator, mgm./100 c.c. blood	Result by Colorimeter, mgm./100 c.c. blood	Difference between Comparator and Colori- meter Results, mgm./ 100 c.c. blood
1	T	8.0	6.6	+ 1.4
	F	6.5	3.5	+ 3.0
2	T	6.0	9.8	- 3.8
	F	5.2	4.4	+ 0.8
3	T	8.0	8.0	0
	F	5.5	3.0	+ 2.5
4	T	7.0	6.6	+ 0.4
	F	4.8	3.7	+ 1.1
5	T	5.0	4.8	+ 0.2
	F	3.5	4.4	- 0.9
6	T	6.0	7.9	- 1.9
	F	4.5	5.0	- 0.5
7	T	5.0	3.8	+ 1.2
	F	3.5	1.8	+ 1.7
8	T	5.0	6.7	- 1.7
	F	2.5	1.5	+ 1.0
9	T	2.0	2.4	- 0.4
	F	1.7	0.8	+ 0.9
10	T	2.0	2.4	- 0.4
11	T	2.5	1.0	+ 1.5
12	T	4.0	5.7	- 1.7
	F	0.6	3.0	- 2.4
13	T	5.5	6.0	- 0.5
	F	3.5	3.6	- 0.1
14	T	6.0	3.9	+ 2.1
	F	4.0	3.2	+ 0.8
15	T	6.5	6.4	+ 0.1
	F	5.0	3.9	+ 1.1
16	T	6.0	6.0	0
	F	4.0	3.2	+ 0.8
17	T	8.0	7.3	+ 0.7
	F	6.0	5.9	+ 0.1
18	T	5.0	5.0	0
	F	3.0	2.1	+ 0.9
19	T	5.0	7.6	- 2.6
	F	3.5	4.3	- 1.8
20	T	4.5	5.7	- 1.2
	F	3.0	4.0	- 1.0
21	T	4.0	4.6	- 0.6
	F	2.5	2.1	+ 0.4
22	T	3.8	3.2	- 0.6
	F	2.4	1.3	+ 1.1
23	T	1.5	1.4	+ 0.1
24	T	1.0	1.3	- 0.3
25	F	4.0	3.5	+ 0.5
26	T	6.0	5.3	+ 0.7
	F	3.2	2.9	+ 0.3
27	T	2.8	1.9	+ 0.9
28	T	4.0	3.0	+ 1.0
	F	2.5	1.8	+ 0.7

33 estimations were made on blood samples from five patients on sulpha-pyridine treatment. The earlier parallel estimations, for the reasons given above, had shown wide differences. The results of the last 15 estimations are shown in Table III ; in 93 per cent there was a difference of less than 1.5 mgm.

TABLE III.—ESTIMATIONS OF BLOOD SAMPLES FROM SULPHAPYRIDINE-TREATED PATIENTS.

Sample	T or F	Difference between Comparator and Colori- meter Results, mgm./100 c.c. blood		
		Result by Comparator, mgm./100 c.c. blood	Result by Colorimeter, mgm./100 c.c. blood	
29	T	2.0	2.0	0
	F	2.0	1.4	+ 0.6
30	T	2.0	1.6	+ 0.4
	T	2.5	1.7	+ 0.8
32	T	1.3	1.5	- 0.2
	T	3.5	4.8	- 1.3
33	F	2.0	1.3	+ 0.7
	T	2.8	3.0	- 0.2
34	F	1.6	1.6	0
	T	4.8	3.2	+ 1.6
35	F	2.7	2.1	+ 0.6
	T	0.6	1.9	- 1.3
36	F	2.8	1.7	+ 1.1
	T	2.0	1.9	+ 0.1
37	F	1.4	1.4	0
	F	1.4	1.4	0

DISCUSSION

Perfect agreement between the comparator and colorimeter cannot be expected. From the results presented in Tables II and III, it is seen that 85 per cent of the estimations of sulphanilamide and sulphapyridine by the comparator differ from those by the colorimeter by less than 1.5 mgm./100 c.c. blood. The difference is distributed at random among high and low estimations and among those of the total and free sulphonamide and appears to be due to an unexplained factor inherent in the present technique. Nevertheless, the accuracy obtained with the comparator justifies its use in field hospitals particularly when its other advantages of compactness and size are considered.

CONCLUSION.

The Lovibond sulphanilamide comparator is simple and quick to use, light and compact and fairly inexpensive. Its accuracy seems sufficient to warrant its use in a hospital laboratory. With some practice, and using uniform illumination, results within 1.5 mgm./100 c.c. of the blood sulphonamide value using a colorimeter may be obtained.

We are indebted to Colonel H. F. Humphreys, M.C., late Royal Army Medical Corps, for access to the clinical material.

We wish to thank Quartermaster-Serjeant W. K. Cooper and Serjeant E. O. Morris for technical assistance.

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VARICOSE VEINS AND THE SOLDIER.

BY MAJOR WILLSON PEPPER, M.A., M.B., B.Ch., F.R.C.S.,

Royal Army Medical Corps.

IN the course of this article it is not my intention to discuss at length the treatment of varicose veins but to bring forward a number of points that have come to my notice while treating fairly large numbers of soldiers for this condition and which I think worthy of consideration.

For various reasons, such as saphenous reflux past an incompetent saphenous valve, failure of previous injection to induce thrombosis, or the presence of a cough impulse, I have thought it necessary to combine injection treatment with ligation of one or more veins in a fairly high percentage of patients. By carefully sorting the cases and by combining ligature with injection it has been possible to discharge many patients in a comparatively short space of time, with what appear to be eminently satisfactory results.

In the twelve weeks ending on April 12, 1941, the time of writing, the average number of cases seen weekly at the Varicose Vein Clinic has been approximately fifteen. It is regretted that owing to enemy action representative figures for the cases treated from last September onwards cannot be given but, in any case, all that is required for my present purpose is to give a rough idea of the numbers under treatment at this hospital.

In spite of the fact that those cases chosen for operation were more severe than the others, almost all of them have been discharged after less than half a dozen injections following ligation with all the main varicosities thrombosed. Frequently one or two injections at weekly intervals below the knee have sufficed. Some of these men had had as many as twenty previous injections at various times in the past, without obvious result.

It is all the more surprising therefore that a small but definite minority of men refuse operation, although prepared to go on apparently indefinitely with injections alone.

I have endeavoured to discover the reasons for refusal of a course of treatment which to the surgeon seems so eminently satisfactory, being simple to perform and of lasting benefit. The reasons for refusal given by the men themselves are broadly speaking as follows :

- (1) That their mother had varicose veins for years and that nothing could be done for her.
- (2) That he or a friend had had the operation and that the veins were as bad as, or worse than, before.
- (3) That the patient was afraid that the operation might ruin his leg for future use.
- (4) That the patient did not like or want operation, with no reason given.

I should state that the majority of these men seem to be of two types ; those

de intelligence and those who are obviously highly nervous and apprehensive. I will endeavour to analyse these replies one by one in the light of experience.

1.—That his mother had varicose veins for years and that nothing was done for her.

It is well known that large numbers of middle-aged women suffer from varicose veins and often ulcers, and that they frequently regard such a disability with a fatalistic calm, disdaining all treatment and decrying the possibility of cure. Sometimes expressing the view that to heal the ulcer and stop the pain would "drive the poison inwardly."

In the light of all this it is not therefore surprising that some young men, who have had to listen to this kind of thing from their mothers for years, should have a gloomy view of the prospects of cure.

2.—That he himself or a friend had had the operation and that the result was as bad as, or worse than, before.

Two numbers of points arise here. In a few cases this is an excuse to avoid operation. In others an operation has been done and has been unsuccessful, in that the expected-for thrombosis following injection has not taken place, for various reasons. In some cases a saphenous ligation has been done too low, so that the collateral veins joining the main vessel between the ligature and the entry to the femoral vein have not been blocked. In others the reflux occurs lower down the thigh, or from the popliteal vein, so that the commonly practised ligation of the saphenous vein at its upper end has been too high to be effective.

Careful testing with a rubber band round the thigh at different levels should be made to prevent this mistake.

This is done by raising the limb and emptying the veins by upward massage, then applying the rubber band and then making the patient stand. If the band is applied above the leakage, the varicose veins below will quickly fill. If not, they should remain empty or at the most fill gradually.

In yet others an attempt to ligate the saphenous vein has been made through a skin incision placed too far out to find the vessel. In one case this mistake was made on both sides, for operation scars were found nearly 2 inches away from the veins, which could be seen running past them well to the inner side.

The precaution of marking the skin over the vein in the erect posture before operation would have prevented this from happening. If the line of the vessel is not visible, it may often be seen and almost always felt on making the patient lie on his back.

There are some, a most unfortunate group, who have had operative treatment followed by injection, with a first class result from the surgeon's point of view, and who proclaim that their veins have never felt worse.

The explanation for this is, I feel sure, that after a series of unsuccessful injections which have left no residual discomfort whatsoever, an extensive thrombophlebitis has followed ligation and injection, and the patient for the first time has had aching and stiffness, which he very rightly ascribes to operation. This comes as a great shock to an able bodied soldier who has never had a day's pain

in his life and he will not hesitate to tell his companions about it, and to say what he thinks of operations in general and surgeons in particular. Long afterwards, when the veins have shrivelled away, he will not in many cases think back to the days when they swelled and ached and compare results. But he may still remember with a sense of injury that he had once been fool enough to allow operations to be done on him and that he had had to pay for it afterwards with days of discomfort. I believe this happens quite frequently and I can only suggest that the patient be fully warned that a successful result will begin by being painful and that he be not sent back to duty too soon.

Reason 3.—Fear that the leg would be injured.

This may occasionally be an excuse to avoid operation, but I believe more often is given for the reason stated above, namely that a friend has had a painful and stiff leg afterwards.

Apart from one injection ulcer, I have never seen any real harm result from either injection alone or from combined injection and ligature in any of these men. I have never seen a soldier in whom the ligature or injection of a superficial vein has been done in the presence of an unspotted deep thrombosis, or in whom the femoral vein has been tied in error. I should expect both of these mistakes to have a serious effect on the future efficiency of the soldier.

It is not known what substance produced the injection ulcer mentioned above, as the patient had had it several weeks when he first attended the Clinic.

Aching, stiffness and tenderness, sometimes lasting as long as a couple of weeks, has followed an extensive thrombosis and many of the men have complained about it. A few isolated cases have felt faint after injection, and one or two who have had extensive thromboses following the combined treatment have felt off colour for a day or so.

Reason 4.—The patient did not like or believe in operations, with no reason given.

In addition to what has been stated above, there may be all kinds of prejudices and complexes of interest to the psychologist. I have more than once referred to an excuse for avoiding operation without suggesting a reason. This is a big question largely of psychological interest, but in addition there are, in my view, a certain number of men who think that varicose veins are not a condition sufficiently serious to warrant such drastic treatment and that injection is the utmost length to which they are prepared to go. They hesitate to say so however to a medical officer who obviously does not agree.

There are also occasional patients who regard their varicose veins as a justification for avoiding heavy duty, for being graded down, or for being boarded out of the Army. With all these problems I will not attempt to deal as they are obviously for individual consideration.

The great majority of injection cases have carried on with their normal duties.

Sodium morrhuate 5 per cent, Burroughs and Wellcome, has been used in almost all the cases, not because of any special preference for this substance but because it was available, and because the risk of injection ulcer from its use is small. The only other preparation used was quinine 11·5 per cent and urethane

5.75 per cent, British Drug Houses, which was tried in one or two cases in which sodium morrhuate had failed to produce a thrombosis. In no case was it successful. Most of these cases were afterwards treated by ligature and injection of sodium morrhuate with excellent results.

In my opinion operation cases should be kept in hospital for a week, though never in bed, and should not go back to full duty for a further week if an extensive thrombosis has occurred. I think it undesirable to keep operation cases in bed, even immediately after ligature, which is done under local anæsthesia as, by keeping the leg raised, the affected veins more readily empty and will tend to lose the sodium morrhuate. Moreover, I think there is a greater risk of a pulmonary embolus or of an unpleasant general reaction if the sclerosing fluid diffuses too rapidly into the general circulation.

I have endeavoured to bring forward a few points which have caught my attention in dealing with a mild but important defect in the hope that they may be of some interest to other medical officers.

I wish to thank my Commanding Officer, and also Miss Manning, Q.A.I.M.N.S., R., and Miss Philippa Warner for their valuable assistance.

TREATMENT OF ACUTE GINGIVITIS WITH ZINC OXIDE PASTE AND WOODEN POINTS.

BY CAPTAIN L. J. MOIR,
The Army Dental Corps.

FOREWORD.

THE Dental Officer sees many cases of gingivitis ranging in severity from the acute localized marginal type through the ulcerative conditions to the chronic condition recognized as pyorrhœa alveolaris. These cases tend to occur more frequently in the autumn and winter months, the time at which resistance is probably lower than in the summer, when sunshine, outdoor life and fresh fruit abound to make men fit. One suspects lack of vitamins to be a pre-disposing factor of these gum conditions in the troops.

Bleeding from the gums is usually the first symptom observed by the patient and many men report to the Centre for this reason. I have made below a short summary of ætiology, clinical picture and treatment of these cases in the hope that the treatment details will be of value to Dental Officers who find difficulty in obtaining a satisfactory result with the recognized methods of gum treatment. To make elaborate conservative restorations for teeth surrounded by inflamed, congested gums is, to say the least, unsatisfactory and to clear the gum condition is to obtain an ally in the ranks. The Dental Officer needs such allies if he is to win the confidence and esteem of the troops under his care.

ÆTIOLOGY.

Predisposing factors : Lack of vitamins ; lowered resistance.

(1) Lack of oral hygiene—not necessary but usual. Such a failure to use the tooth-brush is apparent when the patient reports for treatment since previous oral cleansing has caused hæmorrhage and this in turn causes cessation of oral hygiene.

(2) Localized Causes :

- | | | |
|---|---|----------------------|
| <ul style="list-style-type: none"> (a) Partially erupted $\overline{8} \mid 8$. (b) Overhanging fillings. (c) Irregularities of teeth. (d) Retained septic roots. (e) Cervical caries. (f) Tartar deposition causing pockets round teeth. (g) Painful teeth, causing patient to eat on opposite side of mouth, etc., etc. | } | Causing food stasis. |
|---|---|----------------------|

(3) The gingivitis may be infective in origin, i.e. Vincent's angina.

Types of gingivitis.—(a) Acute localized marginal gingivitis ; (b) acute generalized marginal gingivitis ; (c) chronic generalized marginal gingivitis ; (d)

chronic localized marginal gingivitis ; (e) acute ulcerative gingivitis ; (f) infective gingivitis—Vincent's infection.

Clinical Picture of Types A, B, C, D and E.

Early Cases.—Redness of gums in a narrow margin around teeth. Tendency to bleed easily. Tartar shows darkly through gums, i.e. serumal calculus on buccal aspect. Slight tenderness on pressure.

Later Cases.—Gums more congested and bleed more readily. Heavy tartar deposition causing pocketing. Pockets contain food debris and organisms. Halitosis. May be ulceration at tip of papillæ.

Extreme Cases.—Halitosis (bad). Very unhealthy mouth—marked hyperæmia followed by green and necrotic slough. Pockets much deeper and pus may be expelled by pressure—unusual. Ulceration of gingivæ. Lymphatic glands may be enlarged. Loss of gum tissue. Teeth may loosen.

Clinical Picture of Vincent's Infection, Type F.

Bad breath of characteristic odour. Ulceration between teeth, i.e. ulceration of interdental papillæ, and especially around partially erupted 8 | 8, Teeth loosen and are tender.

General conditions poor, e.g. pyrexia, constipation, furred tongue, languor, disinclination to perform normal duties. Sleep may be disturbed.

BACTERIOLOGY AND PATHOLOGY.

Streptococci and a multiplication of normal mouth organisms.

Bacillus fusiformis
Vincent's spirochæte } living in symbiosis.

Since generally the tissues appear clinically normal just below the lesion in ulcerative gingivitis, it seems probable that the organisms do not penetrate very deeply from the surface (Fish, 1938). The organisms causing acute gingivitis seem to be thrust into the blood-vessels near the surface by some trauma which leads to rupture of the blood-vessels with consequent spreading of the infection.

The relative absence of local swelling and pus and the narrowness of the red inflammatory zone suggest that the organisms exert negative chemiotaxis on the leucocytes and indeed a rapidly spreading case reminds one of cancrum oris. The surface necrosis extends so rapidly and the organisms destroy and liquefy the fibrous tissue forming the mucoperiosteum of the gum margins so completely that either they are highly fibrolytic themselves or they are capable of fibrolysis in conjunction with other mouth bacteria. They sometimes destroy so much tissue at the surface that after healing the case presents the same appearance as is seen after gingivectomy (Fish, *Lancet*, 1938).

TREATMENT.

General Principles.—(1) Packing gums with zinc oxide paste.

(2) Removal of tartar, food debris, impacted 8 | 8, badly carious teeth,

septic roots, etc., but *these teeth must not be removed until the acute phase has passed.*

(3) Constitutional treatment, i.e. aperients, rest, supply of vitamins, in the form of fresh fruit (if possible), green vegetables, milk, etc.

Detailed Treatment: Early Cases.—Pack off inflamed area with wool rolls. Drop 20 per cent chromic acid from tweezers around the teeth and follow this with 10 volume H_2O_2 applied in the same way. A deposition of chromic-sesquioxide is obtained. This deposition is a powerful oxidizing agent and rapidly kills any anaerobic organisms. Carefully and gently remove serual calculus. Use any antiseptic mouth wash, e.g. H_2O_2 , or pot. chlor., and this should be used at frequent intervals.

N.B.—This treatment at one or two visits will often clear the condition of an acute localized marginal gingivitis, but if it still persists at the later visits, then pack with zinc oxide paste as detailed below.

Later and Extreme Cases.—Pack immediately with zinc oxide paste. Remove 48 hours later together with any prominent tartar.

Vincent's Cases.—Pack immediately with zinc oxide paste for 48 hours. Remove and repack for five days.

N.B.—After packing is removed finally then patient is instructed in daily use of wooden tooth-picks.

N.B.—Thorough scaling *after* acute condition has subsided; also old toothbrush to be burnt, a new one of medium hardness to be obtained.

Principles and Technique of Zinc Oxide Treatment.

(a) *Principles.*—It is assumed that the organisms are confined to the surface slough and an attempt is made to kill them by covering them and the gum margins with a persistent disinfectant which can be kept in position for some days. A paste of zinc oxide and eugenol or oil of cloves (Rideal-Walker coefficient $\times 8$) seems ideal for it sets as a firm splint over the gum margins affording to them the necessary disinfection and rest. The invading organisms then come to lie between a disinfectant pad above and the leucocytes below and this combination rapidly kills them (Fish).

The result of a zinc oxide pad is very satisfactory; within a few hours all pain and distress cease and the patient can at once resume normal diet. When this dressing is removed forty-eight hours later, the whole gum margin is a delicate pink colour and entirely free from slough, acute inflammation or undue tenderness. The packing, however, is replaced for a further five days before the energetic after-treatment is instituted. This after-treatment consists in the daily massage with thin wooden points to keratinize the epithelium covering the gum margin, and this keratinous layer prevents the seepage of soluble toxic matter into the underlying connective tissues where it would set up chronic inflammatory changes. The rubbing must be done interstitially, labially and lingually around every tooth. Should there be any loose tags of gum, these should be removed after the acute condition has subsided and prior to the use of the tooth-picks.

(b) *Technique.*—(1) Zinc oxide and eugenol or oil of cloves mixed into a very thin paste.

(2) Wisps of cotton wool saturated in the mixture are tucked into the interdental spaces with the utmost gentleness, particular care being taken to introduce them between the loose gum margins and the teeth. The paradontal sulcus of every tooth must be filled with the paste. More wisps are spread over the first and pressed gently into place with a moist swab and smoothed over with a gloved finger. The mixture rapidly sets in the presence of moisture.

(3) Remove the cement thus formed after forty-eight hours and repack.

(4) Five days later. Remove packing again and teach the patient to use wooden points daily and, if possible, to get a soft toothbrush. Thoroughly scale and polish all cervical margins of fillings (little tendency to bleed will now be observed but it is essential to remove all tartar).

(5) Ultimately remove partially erupted $\overline{8 \mid 8}$ since pockets around these can neither be cut away nor kept clean. All gum tags must be cut away and if necessary the paste repacked before massage with tooth-picks is instituted.

CONCLUSION.

The successful effect of the zinc oxide and oil of cloves dressing on the gingival tissues is perhaps an indication of the superficial habitat of the infecting organisms but, certainly the possibility of holding an antiseptic of such strength continuously and safely in contact with the gum margin is a valuable weapon in fighting any acute infective condition of the gums whether of the Vincent type or frankly streptococcal. Its effect is a striking demonstration of the accessibility and tractability of oral infection (Fish, *Lancet*, 1938).

Many of my own cases have been treated by the above method and results are extremely good. Intelligent co-operation of the patient is required but once this has been obtained and the enormous value of oral hygiene established in his mind then the treatment becomes eminently satisfactory both to patient and operator, while much valuable time is saved and the number of visits for treatment is greatly reduced.

I am greatly indebted to Dr. E. W. Fish for his articles and the help given at a personal interview.

Papers by E. Wilfred Fish, M.D., D.D.Sc., D.Sc., used for reference in this article :

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Editorial.

THE BRITISH EMPIRE CANCER CAMPAIGN.

THE Eighteenth Annual Report of the Grand Council for 1941, issued in February, 1942, and edited by Mr. J. P. Lockhart-Mummery, M.A., M.B., F.R.C.S., is full of interesting matter very well presented, and makes delightful reading to all those interested in the problems of cancer. It must be read in the original, however, if the whole vista of facts is to be appreciated and we strongly recommend it to officers of the Royal Army Medical Corps. Here we do not attempt to refer to anything beyond the pathological and bacteriological problems set forth as of interest. Lack of space makes it necessary to leave out of consideration the many physiological, chemical, physical and radiological observations which are to be found in this admirable Report.

Referring to the venous spread in rectal cancer, Lockhart-Mummery says that this mode of propagation can rarely be detected by inspection or handling and that a dissection of the veins is usually required. For this purpose, the specimen is opened along the mid-line anteriorly and sewn out on a rectangular meccano framework thus preserving its natural relations. The specimen is then fixed in 10 per cent formalin for forty-eight hours. In the dissection which follows it is found best to begin with the ligated end of the superior hæmorrhoidal vessels and to work down the vessels until the terminal branches are seen to disappear through the muscle coat into the submucosa. The fat and connective tissue are gradually removed, leaving in situ the veins, lymphatic glands and other deposits of carcinoma. At this stage it is well to prepare a plan in which all these structures are plotted. Portions of the veins, glands and extra-rectal deposits are then examined microscopically. "The most likely place to find intravascular extension is where the veins emerge from the region of the growth." Evidences of intravenous extension are more suggestive of growth along the veins by permeation than of embolism. "The malignant tissue grows along the vein in the same sort of way as a calculus grows down the ureter, by the constant deposition of new material at the growing 'beak.'" Evidence of this venous spread was found in 16.6 per cent of the specimens but this is probably an under-estimate. An interesting correlation was found between the extent of spread and the influence of venous spread. No instance of the latter was found where growth was limited to the rectal wall. Intravascular growth was found in 35 out of 213 cases in which growth extended to the extra-rectal tissues but in which there were no lymphatic metastases. Amongst the 360 cases in which there were metastases in the lymphatic glands, 76 were found to show venous spread. The fact that there was so little difference between the two latter shows that the invasion of the veins must take place from the primary growth and not from the lymphatic metastases.

In a previous Report it was stated that abnormalities had been produced in

paramecium by exposure to blastogenic agents such as cyclic hydrocarbons, γ and ultra-violet radiations, heat, cold and hypertonic dextrose. "These abnormal cells, when removed from the agents and placed under normal conditions, give rise to sets of polymorphic cells varying greatly in size and form, from formless monsters to cells apparently normal." Although no particular abnormality is transmitted there is a transmitted proneness to abnormality. The descendants of very abnormal cells are all abnormal. The descendants of the apparently normal cells are nearly all normal but a very few are always found to be abnormal.

In the case of the cyclic hydrocarbons a concentration of about one in a million was used. The cultures were subcultured every few days and examined for abnormals which, however, usually took several weeks to be apparent. With small daily doses of ultra-violet and γ radiation, produced for one or two seconds each day by exposure to a mercury vapour lamp and about 160 röntgens daily, several weeks treatment was likewise required. Single exposures to heat or cold usually sufficed. The same delayed occurrence of abnormals was equally found with hypertonic dextrose, acetic, butyric and carbonic acids. "The number of abnormal cells produced by exposing cultures of *paramecium* to the blastogenic agents is small." "This occasional production of abnormal cells resembles the experimental production of tumours when only a very few tumours result from the exposure of hundreds of thousands of cells to blastogenic agents; in skin painted with blastogenic hydrocarbons only a few tumours appear in a punctate manner."

In the exposure of *paramecium* to the same blastogenic agents many kinds of abnormals are produced, doubles, trebles, quadruples, higher multiples and cells of intermediate constitution; these by further division give rise to the polymorphic races already described. "It seems likely that these changes in *paramecia* and in two other forms of ciliates produced by blastogenic agents are the equivalent of tumours in multicellular animals. If this is the case it enables a very detailed enquiry to be made into the origin of tumours." Detailed work on the nuclear apparatus of bacteria is going on at the Strangeways Laboratory, the *B. mycoides* being the aerobic spore-bearing bacillus chiefly studied. Nucleoid bodies are observed to occur and to undergo development in the young organism as it leaves the spore case, the chromatic figures, too, dividing and multiplying. Apart from *B. mycoides*, chromatic structures have been demonstrated in *B. megatherium*, *B. mesentericus* and *B. subtilis*.

There are many more subjects of the greatest interest in the Eighteenth Annual Report, but we are obliged to leave them to the attention of any student sufficiently attracted to study the original.

Clinical and other Notes.

A STUDY ON THE CULTURE OF THE TUBERCLE BACILLUS BY THE LOWENSTEIN-JENSEN MEDIUM.

BY CAPTAIN P. N. BARDHAN, I.M.S.

THE common methods of diagnosis of pulmonary tuberculosis are clinical examination, microscopical examination of the stained sputum, and radiography, or by a combination of these methods. Animal inoculation is not done generally except in institutions and it takes at least three weeks and often more to obtain reliable positive results. The Lowenstein-Jensen medium has been reported upon favourably from several sources claiming that positive culture results can be obtained by this method more quickly than by any other. The present study was undertaken to try out this medium and the work was done during a two and a half year period when the writer was in charge of the Brigade Laboratory at Jhansi. Material for the study was obtained from the local military hospitals, the cantonment general hospital and from private cases.

The work was divided into three blocks and, while work proceeded in all three blocks at the same time, the results are given under the block headings.

Block 1. This consisted of the sputa from proved open cases of pulmonary tuberculosis.

Block 2 consisted of cases diagnosed as pulmonary tuberculosis either clinically or radiographically but in which tubercle bacilli had not been found by the ordinary microscopical methods.

Block 3 included sputa from cases of bronchitis which on clinical grounds were non-tuberculous and in which tubercle bacilli had not been found microscopically.

The technique employed was as follows :

Twenty-four hours' sputum was collected and brought to the laboratory the next morning. No antiseptic was ever added to the sputum which was mixed with 4 per cent caustic soda in the proportion of 1 to 3. The resulting mixture was then centrifuged at 3,000 r.p.m. for forty minutes and the deposit neutralized with 8 per cent hydrochloric acid, added drop by drop, the reaction being tested by touching a litmus paper with a platinum loopful of the mixture. The neutralized deposit was inoculated with a pipette over three tubes of the medium which was made by the technique described in " Handbook of Practical Bacteriology " by Mackie and McCartney (1938).

The results are summarized below :

<i>Block.</i>	<i>Number of cases.</i>	<i>Positive culture.</i>	<i>Negative culture.</i>
1	52	39	13
2	47	30	17
3	76	11	65
Total	175	80	95

The earliest positive result was read on the ninth morning and the latest on the twenty-fourth. No culture was considered negative till the fiftieth day.

In block 1 faulty media were responsible for four of the negatives but, for the other nine negatives, no explanation can be offered unless it be some technical error. The deduction from the results of block 1 are that about 75 per cent cases will yield positive results by the Lowenstein-Jensen medium.

In block 2, of the 30 culture positive cases, 17 became sputum positive microscopically within six months, 5 within nine months, and 1 remained sputum negative for a year when he was lost sight of. The remaining 7 ceased to attend from early in the course of the investigation. Of the 17 negatives 5 became sputum positive within four months, 2 within nine months, and the remaining 10 were lost trace of. It will be seen that about 64 per cent cases gave positive results by the culture method, and therefore helped in the earlier inauguration of treatment. The negative results do not detract from the value of the method.

In block 3 the results were somewhat surprising. The eleven positive cases were moving about in the community supposed to be suffering from winter cough and weak chest. As repeated microscopical examinations had failed to show any tubercle bacilli in their sputa they were naturally not very careful about their own health or with their sputa and thus they constituted a potential source of danger to the community. Of the sixty-five negatives only nineteen could be followed up and they remained sputum negative for a year though radiographically two have since been diagnosed as pulmonary tuberculosis. The conclusion drawn from block 3 is that culture of sputum is helpful.

CONTROL.

A comparative study has not been made with other recognized methods of culture for the tubercle bacillus neither have the results of this series been compared with the plain anti-formin method. A few animal inoculations have been done however and the results are tabulated below :

<i>Case No.</i>	<i>Culture result by Lowenstein-Jensen medium</i>	<i>Result of animal inoculation</i>
3	Positive	Negative
4	Positive	Positive
5	Positive	Positive
19	Negative	Positive
20	Positive	Negative
21	Negative	Negative
32	Positive	Negative
33	Positive	Positive
34	Positive	Negative

In five of the nine cases the results vary and in four they are the same. These numbers are of course too small to have any statistical value but they would appear to suggest that culture by Lowenstein-Jensen medium gives slightly better results than animal inoculation. Of course the inoculation method is also valuable as shown by the results of case 19 in the above series.

SUMMARY.

1. A series of 175 cases of pulmonary tuberculosis has been studied by means of Lowenstein-Jensen medium.

2. While the results may not have much statistical value, owing to the smallness of the number, they suggest that culture of sputum by the above medium is a helpful procedure in early and sputum negative cases of pulmonary tuberculosis.

3. The negative culture results do not detract from the value of the positive results.

4. Further trials by this medium are recommended.

It should be added that the acid and alcohol fast bacilli found on culture have not been made to comply with Koch's postulates.

I wish to thank Lieutenant-Colonel H. S. Rajan, I.M.S., the Senior Medical Officer of Jhansi, who first suggested this study to me and who all along has given very helpful suggestions and criticisms. I also thank him for access to the cases in the military hospital under his command. Jemadar P. N. Mehra, I.M.D., has given material assistance in all technical matters and to him I express my gratitude. Captain B. B. Das, sometime Civil Surgeon of Jhansi, allowed me to obtain material from three of his cases. Mr. J. A. Righton, I.M.D., of the X-ray department of the British Military Hospital of Jhansi, very willingly placed the resources of his department at my disposal.

CHEMICAL DISPOSAL OF SEWAGE.

BY MAJOR D. P. HOLMES,

Royal Army Medical Corps.

ORIGINAL experiments with the bucket type of chemical closet showed them to be unsatisfactory in Army use. The bucket fills quickly at the 5 per cent provision rate (i.e. 20 users per day) and the excreta form a mass standing above the level of the fluid. Daily emptying is required. A similar result can be obtained by the use of an ordinary latrine bucket with some added chemical fluid without the use of any special container.

Chemical disposal has obvious advantages in hygiene and convenience, the former being universal in immunity from flies, the latter particularly in areas where rock or geographic conditions make other forms of disposal impracticable.

Various experiments were carried out and conclusions may be divided into those regarding the fluid and those of design of closets.

Regarding composition of the fluid it was found that a mixture of sodium hydroxide and cresol was efficient. The former is important in disintegration and the latter in disinfection and deodorization. A suitable mixture was found to be 10 per cent caustic soda and 3 per cent cresol, i.e. 2 lb. of caustic soda, $\frac{1}{2}$ pint of cresol made up to 2 gallons with water. This worked efficiently until



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dilution of 6 to 7 times was reached, i.e. $1\frac{1}{2}$ per cent. Fæces and soft paper disintegrated satisfactorily but newspaper did not. Sufficient fluid to cover the excreta is necessary, and agitation of the fluid periodically is essential to ensure mixing and avoidance of a pile of fæcal matter untouched by fluid.

The possibility of burning of the skin by the fluid was raised on many occasions. Experiments were carried out by smearing 10 per cent caustic solution on the forearms of twenty individuals. In fifteen no reaction occurred, and in the remaining five slight tingling and redness was described. No true burning occurred. In the appliances described below, no such complaint was made in actual use although one unit put appliances into use without authority or instruction and took no precaution against such occurrence. Actual fluid on the anal region will undoubtedly give discomfort but as it would be quickly wiped off should not cause damage. Anti-splash devices are therefore necessary.

For satisfactory service, the container must be modified from the simple bucket. In designing the appliances described the principle worked on was that of commencing with a strong solution and allowing dilution to occur as far as efficiently permitted and, by using a large container, thereby prolonging the intervals between emptying. The first type was a simple adaptation of an oil drum by

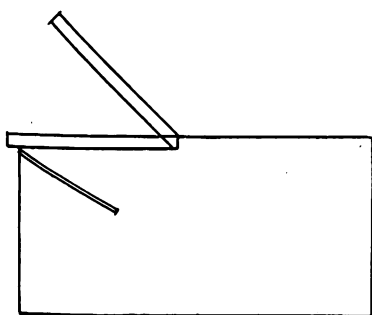


FIG. 1.

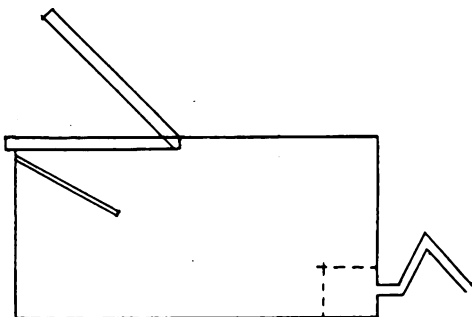


FIG. 2.

fitting a standard type latrine seat at one end, in the curved part of the drum (fig. 1). The drum was of reputed 50-gallon capacity. Two gallons of solution were placed in the drum and emptying carried out weekly by carrying the drum to a conveniently placed soakaway. Daily inspection was carried out and the contents stirred and large pieces of paper and other foreign matter removed with a pointed stick. At twenty users per day, approximately 6 lb. of fæces were added daily and $12\frac{1}{2}$ pints of urine. After seven days, 42 lb. of fæces and approximately 10 gallons of urine would have been introduced. The fluid dilution would therefore give a caustic soda content of 1 per cent. Splashing was minimized by fitting a sloping plate of tin at the front of the seat, projecting downwards at an angle of 45 degrees.

Disintegration of fæces became slow at the end of the week and solid fæces were present on emptying. These were left on emptying, to be covered with fresh solution, and in no way interfered with the efficiency of the appliances.

The second type was tried in an attempt to avoid carrying the drum away from the latrine for emptying. It was similar to the first except that a syphon pipe was fitted to the opposite end of the drum to the seat, so that an overflow occurred at an 8 inch level. The pipe was attached 1 inch from the bottom of the drum to avoid complete emptying and consequent blocking of the pipe with sludge and the inlet of the pipe was fitted with a guard of perforated metal for the same purpose.

The method of operation was simple. Daily inspection was carried out, the contents stirred and wads of paper and refuse removed.

When overflow from the syphon pipe occurred the drum was emptied by tipping it towards the syphon pipe and so commencing syphonage or, alternatively, by pouring a bucket of water into the closet rapidly. A small tin was placed constantly under the pipe for the overflow and the contents on emptying were collected in a 20-gallon drum or suitable container sunk into a trench. They were then disposed of in a deep pit. The remaining matter was then covered with fresh solution and the process repeated.

This type worked reasonably well but required some care and supervision. The method of emptying by syphonage was not always understood by the operators

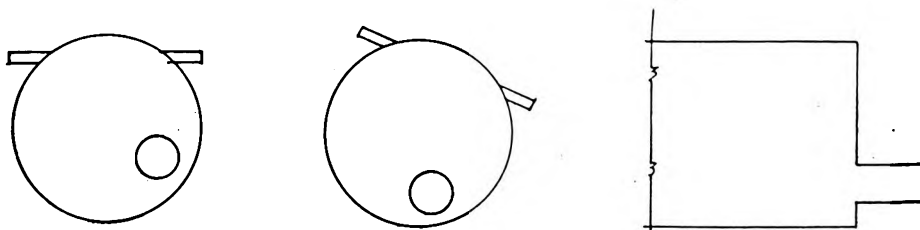


FIG. 3.

and the pipe frequently became blocked from extraneous matter introduced into the closet either from curiosity or as a convenient way of disposal.

As the closet was designed to avoid unnecessary work, these conditions defeated its own ends and the following modifications were tried :—

The drum was constructed as before but without the syphon pipe. In lieu of this, a circular hole was cut, 4 inches in diameter, in such a position that the edge of the hole touched the rim of the drum and that the lower circumference was 8 inches from the ground when the closet was in position for use (fig. 3).

The hole was fitted with a 6 inch metal sleeve to form a pipe clearing the edge of the drum. Maintenance was as for the former type except that, when overflow was noted from the pipe, emptying was accomplished by rotating the drum through a quarter circle to bring the pipe to the lowest level, the receiving container being sunk into the ground as before.

Final disposal was into a pit. Emptying was by gravity and cleaning was accomplished at the same time.

The great advantage of chemical disposal was the fact that the mixture in the

closets proved completely unattractive to flies and that there was no nuisance from unpleasant smell. The only disadvantage found was that success depends to a large extent upon the degree of supervision of maintenance used.

SIMPLE MEANS FOR TESTING THE EFFICIENCY OF IMPROVISED DISINFECTORS AND DISINFESTORS.

BY MAJOR S. KNIGHT,
Royal Army Medical Corps.

DISINFECTION and disinfestation by means of improvised apparatus can be surprisingly efficient, comparing favourably with the results obtained in manufactured machines.

In circumstances where it is necessary to use makeshift methods the usual facilities for testing, such as *témoine* tubes, commercial witnessing tubes, thermocouples, or registering thermometers, will not be available. Resort must therefore be made to improvised methods of testing.

DISINFESTORS.

The surface temperature of articles in a disinfestation chamber should be raised to 70° C. It is unnecessary to reach higher temperatures. Indeed, one of the disadvantages of improvised disinfestation chambers is that articles are liable to become scorched. Therefore a simple temperature indicator is of value both as regards a safe upper and lower limit.

Starch forms a gel at 68° C. but although pure starch may not be available in the field flour is a good substitute.

The method consists of mixing flour and water into a batter, the consistency of thin cream. A little of the batter is placed in a small glass tube and it should run freely on tilting. The tubes should be freshly prepared and used within a period of twenty-four hours. They should be shaken thoroughly immediately before being fixed to the clothing by means of thin wire.

Any small glass tube of the Durham type will do. It may be possible to obtain them from a mobile hygiene laboratory; if not, tubes that have held tablet medicines or the like should be used. An open glass tube cut in sections and sealed at one end by heat or other means suits admirably. It is unnecessary to close them while in the disinfesting chamber. After use the tubes should be cleaned out and used over again.

On heating, no change occurs until a temperature of 60° C. is reached. At 70° C. cooking takes place, the batter becoming solid and somewhat translucent. When this has happened it is unnecessary to go on raising the temperature. If several of the tubes have been distributed about the chamber on the clothing and all have "cooked," one can be confident that disinfestation has been effected.

It will perhaps be possible to put in some tubes, which can be withdrawn easily

from the chamber for observation at intervals, say after a contact period of perhaps twenty minutes has elapsed.

Prolonged heating at temperatures below 60° C. does not produce any change in the batter. At temperatures between 60° C. and 70° C. the time taken for "cooking" is greater than the time required to kill lice and their nits. For example, lice and nits are killed after an exposure to 60° C. dry heat for half an hour, but these conditions will not cause the batter to set.

DISINFECTORS.

In the case of improvised disinfectors there is downward displacement of air by current steam. The steam issuing from the outlet of the disinfecting chamber can itself be used as an indicator. When steam has issued at full bore for three minutes, disinfection should be complete in a current steam disinfecter of good design.

Full bore steam means a strong jet from the vent, uniform in intensity, after all puffs (due to air being expelled) have ceased.

The condensation temperature of steam at about 100° C. is self-controlling and cannot, in such apparatus, be appreciably increased. Thus no harm can come to the usual fabrics disinfected in apparatus using current steam. But some check on the temperature reached throughout the mass of the material will be reassuring.

More use should be made of the potato which can be an accurate guide to temperatures of about 100° C. A potato will not cook at temperatures below 100° C. A slice of potato will have to be maintained at boiling-point for five minutes before it becomes mealy in appearance and for the skin to break away. At 100° C. a mealy ring begins to appear at the junction of the parenchyma and cortex at a depth of about a quarter inch below the skin. Disinfection will not be achieved until the potato is softened and the mealy ring appears.

When using a potato as an indicator of temperature, slices of about quarter inch in thickness are cut. These are distributed among the articles in the disinfecting chamber, particularly in spaces where it is suspected that disinfection may not take place, such as at the bottom corners of the chamber.

The physical agency of heat is used to kill, both in disinfection and disinfection and, as might be expected, satisfactory indicators are to be found among substances of organic origin—even among the limited range that is available in the Field.

Ability to check the efficiency of the apparatus used, increases the operator's interest and confidence in his work—essential considerations if we are to ensure that the job is done thoroughly.

I am much indebted to Colonel E. B. Allnutt, M.C. for his valuable suggestions and for his permission to submit this article for publication.

VEHICLE TACTICAL MARKINGS FOR A FIELD AMBULANCE (Infantry Division).

BY MAJOR STEWART BROWN,
Royal Army Medical Corps.

THE NEED FOR TACTICAL MARKINGS.

THE advantages of having vehicles with distinctive markings has long been recognized. In peace-time the full regimental name and battalion was painted on the door or tailboard. In war, for reasons of security, the name has been replaced by a Unit Serial Number.

The mere Unit Serial Number, however, is not sufficient in these days of rapidly moving warfare. It should be possible to identify any one single vehicle at a glance and recognize the passengers and load it carries. With each vehicle distinctly labelled according to a set plan, it is possible to locate the Commander and subordinate Commanders of any unit or formation while on or off the road.

It is thus for the rapid recognition of passengers and loads of every car or vehicle, for ease of rapid intercommunication and recognition and for co-ordination generally, that the following scheme for the tactical marking of vehicles is submitted.

BASIS FOR CLASSIFICATION.

The scheme proposed is based on the system which has been adopted for some time by the Royal Artillery. This basis is :

- Command Group — Letter Z followed by a Serial Number according to priority of Command, e.g. O.C.—Z.1.
2 i/c—Z.2, etc.
- Company H.Q. — Letter X followed by Company letter. If more than one vehicle then XB.1, XB.2, etc., but only vehicles which are actually Coy. H.Q. are so marked.
- Companies — Company letter ("A," "B," etc.) followed by section number, then an oblique and number of vehicle, thus—A1/2, A3/4, etc.

These letters and numbers are added to the serial number plate immediately above the unit serial number both front and rear.

THE FIELD AMBULANCE.

As applied to the Field Ambulance, the tactical markings have been worked out according to the following table which is largely self-explanatory. The distribution of vehicles is according to the most recent re-organization.

This article was received on March 16, 1942.—Ed.

Allocation (a)	Common Marking Letter (b)	Vehicle (c)	Use (d)	Marking (e)	Remarks (f)
H.Q.	Z	4-str. car	O.C.	Z1	Dental Officer may act as B.M.L.O. or officer acting as such will use car so labelled.
		2-str. car	2 i/c	Z2	
	QM	2-str. car	Q.M.	Q.M.	
	LO	2-str. car	Liaison Officer	L.O	
	H	3-ton lorry	Technical Stores	H1	
		do.	do.	H2	
		30-cwt. lorry with water trailer	do.	H3	
		do.	do.	H4	
		do.	do.	H5	
		30-cwt. lorry	do.	H6	
		do.	W'shops	H7	
		Ambulance Cars	No Tactical Markings are allotted as their distribution depends on necessity and their use is already obvious without further designation.		
Light Section		Motor Cycles	No Tactical Markings are allotted as their distribution and employment varies.		
	HL	30-cwt. lorry		HL1	H.Q. Light Section.
		do.		HL2	
A Coy. No. 1 Light Sec. No. 2 Light Sec. No. 3 Light Sec.	XA	4-str. car	O.C. Coy.	XA/1	As 2 i/c Coy. (Inf.) is marked XA/2.
	A	3-ton lorry	Stores	A1/1	
		2-str. car	O. i/c Sec.	A2/1	
		30-cwt. lorry	Technical Stores	A2/2	
		do.	do.	A2/3	
		30-cwt. lorry	do.	A3/1	
		do.	do.	A3/2	
B Coy.	And similarly for B Coy. with the substitution of the letter B for A as in A Coy. above.				

SUMMARY.

- (1) Suggested vehicle tactical markings for a Field Ambulance (Infantry Division) are recorded.
- (2) They might prove a basis for uniformity in all Field Ambulances.
- (3) The identification of any vehicle is a simple matter.
- (4) Ambulances and motor cycles are not marked as their distribution varies, and their employment is obvious.

I am indebted to Colonel R. W. Galloway, D.S.O., A.D.M.S., for permission to submit this article for publication.

ANURIA FOLLOWING SULPHA-PYRIDINE THERAPY.

BY MAJOR JOHN C. NICHOLSON,

Royal Army Medical Corps.

AND

MAJOR L. C. HILL,

Royal Army Medical Corps.

In view of the widespread use of sulpha-pyridine in infectious illness, a record of the following case may be interesting.

Case Report.—A Warrant Officer in an infantry regiment was admitted under our care from an outside V.D. hospital, having had complete suppression of urine for thirty-six hours and partial suppression for three days.

History.—Urethral discharge with painful micturition for three days before admission to V.D. Clinic. On examination, profuse purulent urethral discharge with enlarged, but not tender, inguinal glands. Smear showed pus, epithelial cells and gonococci. He was given the customary intensive short course of treatment, on the day following admission, with M & B 693: 7 grm. on the first day in doses of 8, 4 and 2 tablets; 5 grm. on the second day in doses of 3, 4 and 3 tablets; and 5 grm. on the third day in doses of 3, 4 and 3 tablets. Apart from a slight feeling of nausea and an occasional headache, he showed no sign of intolerance and his urine remained clear during the time of administration. He did not, however, co-operate in the matter of drinking large quantities of water, taking objection to the taste produced by heavy chlorination. At the end of the three days' treatment he had no discharge, his urine remained clear and was stated to be normal in amount (no measurements of intake or output were recorded) but he is stated to have become troublesome, was surly in manner and fell foul of the nursing staff and all around him.

Twenty-four hours later he passed half a urine glassful of mahogany-coloured urine and again six hours later a similar quantity of a lighter and more normal-looking urine. On the following morning he passed about half an ounce of what appeared to be pure blood, followed after an hour by about six ounces of blood-stained urine and again two hours later by a smaller amount of much clearer urine. From this time onwards he passed nothing and was sent into the Military Hospital thirty hours later. During this time he had begun to complain increasingly of frontal headache, vomiting and pain across the back and in the lower abdomen and he appeared drowsy. Treatment before admission had consisted of mist. pot. cit. $\frac{1}{2}$ oz. t.d.s., and he had had 2 rectal salines, each of half a pint, which he had retained.

On Admission.—He was complaining of moderately severe headache, pain across the lower back, was slightly drowsy and inclined to be a little incoherent with tongue deeply furred and dry; face bloated; œdema round the eyelids; slight cyanosis. Skin was dry and hot. Kidneys were not palpable or tender.

Bladder appeared empty. Pulse 110 of good volume. Blood urea was found to be 216 mgm. per cent.

It was late at night and literature on the subject of treatment not immediately available so it was decided to employ old-fashioned methods. He was first of all immersed in a hot bath and was then given an enema which he retained. A second enema produced a constipated result. This was followed by a rectal saline which he retained. Very hot bread poultices were applied repeatedly to the loins and he was given an alkaline mixture containing pot. cit. gr. xxx, pot. bicarb. gr. xx, sod. bicarb. gr. xx, aq. chlorof. ad 1 oz., 4-hourly. At the same time he was persuaded to take fluid copiously by mouth. Six hours later he passed about 8 oz. of thick brown sludgy urine and then continued to pass large quantities of blood-stained urine until he had passed altogether 48 oz. at the end of twelve hours. From this time onwards his progress was uninterrupted. Thirty-six hours after the time of admission his blood-urea had fallen to 32 mgm. per cent but he continued to pass blood in his urine for a further five days. At the end of seven days his urine was entirely free of albumen and blood cells. A microscopic examination of the first specimen passed after the period of anuria showed, in addition to large numbers of red blood cells, crystalline masses of acetyl sulpha-pyridine.

It is not proposed to do more than comment briefly on the case, as the whole subject was recently carefully reviewed by Laird (*B.M.J.*, Sept., 1941). The case will, however, serve as a reminder of this very serious, if occasional, complication of intensive treatment with sulpha-pyridine and sulpha-thiazole. Three stages are enumerated by Laird :

Stage 1. Microscopic hæmaturia.

Stage 2. Hæmaturia gross and associated occasionally with pain in the back and abdomen.

Stage 3. Impairment of renal function with suppression of urine, nitrogen retention, and imminent danger of death.

In the first two stages, stopping of the drug and the giving of ample fluids will quickly relieve. In the third stage more active measures must be quickly undertaken—hot bath, rectal fluids, constant irritation to the loins, morphia and atropine, and it may be necessary to catheterize the ureters and wash out the pelvis of the kidneys repeatedly with normal saline, at body temperature, under local anæsthesia. On very rare occasions it has been necessary to carry out decapsulation, pyelotomy and retrograde catheterization.

The important factor is to ensure that sufficient fluid is taken during and after the course of sulpha-pyridine. At least 6 pints a day should be drunk and more if possible. The administration of alkalies is of no value in view of the established fact that acetyl sulpha-pyridine is equally soluble in solutions varying from pH 3 to pH 7. The routine microscopic examination of the urine at least once during and immediately after the administration of the drug should be insisted on.

Current Literature.

ESKEY, C. R., and HAAS, V. H. **Plague in the Western Part of the United States.**—*Public Health Bull.* No. 254. Washington. 1940. Pp. v + 83. With 61 figs. [Numerous refs.]

This important work some of which has already been abstracted is divided into the three parts: Introduction of plague and its spread, flea investigations, and demonstration of plague infection by inoculation of parasites. Each of these parts has its summary, which is full of detail. The photomicrographs of fleas found on rats and on the various animals subject to sylvatic plague are clear and useful. Some of the points dealt with are :

Plague spread gradually among wild rodents and attracted little or no attention till 1934, by which time it had spread over a vast region extending from the Pacific coast to the Rocky Mountains. The rodents affected and forming reservoirs of plague are divisible into the ground squirrels, the wood rats and the prairie dogs. It seems probable that plague has not yet reached beyond the Rocky Mountains. Although this epizootic condition is widespread it does not seem to have given rise to, or been accompanied by, domestic rat infection and this accounts likewise for the comparative infrequency of human infection.

Some fifty species of fleas have been found to infest the wild rodents of the Western States and these may show a certain degree of specificity for their hosts, but it is not quite complete. It is a mistake to judge of the degree of flea infestation solely from the insects which can be collected from the body of the captured animal, for this would leave out of account those which are to be found in nests and runways. Nevertheless, plague infected fleas are likely to survive for any length of time in abandoned nests. The fleas only become infected when the blood of the host contains a sufficiency of plague organisms. Thus, experimentally "only 32 per cent of exposed fleas were infected by the blood of guinea-pigs found to contain over ten plague organisms in each microscopic field . . . while not a single flea was infected when bouillon culture failed to show the presence of *P. pestis* in the blood of sick animals." It was found that most plague infected fleas harboured virulent organisms throughout their lives, the life span, after a flea had transmitted plague for the first time, being on the average three days, with occasional survivals of seven to eleven days. Before the infected flea however could transmit plague a period of incubation, called extrinsic incubation, has to take place and this varied in experiments from 5 to 130 days. The period may be shortened by increases of temperature and by other factors, and it is obvious that the shorter the extrinsic incubation the more rapidly the disease will be disseminated. The life of the

flea does not seem to be affected by plague infection until blockage occurs, when the flea dies of starvation.

When collecting fleas from rodents with a view to inoculating laboratory animals, it is necessary to bear in mind that chloroform and ether are apt to destroy *P. pestis*. It is better, therefore, to use cyanide gas for this purpose. It is also better to make flea inoculation tests as soon as possible after collection of the parasites during warm weather to avoid attenuation of the bacillus. "At ordinary refrigeration temperatures *P. pestis* harboured by fleas may retain their virulence for three to six months or longer." Again, a method of transportation of fleas to be used for inoculation of guinea-pigs is in 2 per cent salt solution. This inhibits the growth of putrefactive and other bacteria. A final word is said on the importance of inoculation of the fleas of wild rodents as a method of detecting the existence of plague among them, because this is a more reliable and sensitive test than the examination and inoculation of the tissues.

W. F. H.

Reprinted from "*Tropical Diseases Bulletin*," Vol. 38, 1941, No. 6.

FOY, HENRY, and KONDI, ATHENA. **A Case of Miscarriage following Blackwater Fever.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1941. Jan. 31. Vol. 34. No. 4. Pp. 343-346.

Details are given of a case of blackwater fever in a pregnant woman who gave birth to a seven months' child, which died shortly afterwards, thus enabling post-mortem examination of the child and the placenta to be made.

The placenta was intact and appeared normal. The blood was withdrawn from it and centrifuged. The serum was reddish-brown and contained hæmoglobin and methæmalbumin. The placental blood was loaded with schizonts of *P. falciparum*.

The child had been dead for five hours when it was examined. It appeared to be a normal, well formed, seven months' male child. There was no icterus. The serum, which was obtained with difficulty, was clear, but spectroscopically showed a faint band of hæmoglobin in a cell 5 centimetres thick; this was, no doubt, traumatic. There was no trace of any methæmalbumin, nor was there any sign of malaria parasites or of pigment in the infant's blood or spleen.

The mother's blood, examined after the birth, contained both hæmoglobin and methæmalbumin, and the urine contained hæmoglobin and methæmoglobin. From this case it would appear that methæmalbumin does not pass over the placenta to the child.

The authors consider that the absence of any sign of hæmolysis in the child may be explained on the hypothesis:

"(a) That any hæmolysins circulating in the mother did not pass through the placenta to the child.

"(b) That any hæmolysin present in the mother was only there in

sufficient concentration to bring about hæmolytic process in the mother, and none was available to produce a hæmolytic process in the child.

"(c) Assuming that malaria parasites, or their metabolic products, are necessary for the production of blackwater fever, then the absence of all traces of parasites and malaria pigment from the baby may account for the absence of all signs of hæmolysis in the child. Further, sensitization of the mother did not appear to affect the child.

"(d) That the cells of the mother were more liable to hæmolysis than those of the child; or had been sensitized by parasites or their metabolic products."

W. Y.

Reprinted from "Tropical Diseases Bulletin," Vol. 38, 1941, No. 6.

NELSON, N. A. **Why don't we Stamp out Gonorrhœa?** *Venereal Dis. Information.* 1940, Oct., v. 21, No. 10, 313-19, 4 charts. Also in *Med. Officer.* 1941, Mar. 15, v. 65, No. 11, 89-91, 4 charts.

Nelson comments strongly on the relative neglect of gonorrhœa in U.S.A. Data collected from the health departments of 33 States show that 16 have no programme for combating this disease, 7 include it but put much the greater stress on syphilis, and only 10 are more or less impartial in their measures against both diseases. Of 111 clinics in the States investigated [presumably outside the author's State] only fourteen treat gonorrhœa. The author deplores the defeatist attitude of so many health departments towards gonorrhœa and points out that in Copenhagen before they had the help of the sulphonamides they had effected a decline in incidence to 700 per 100,000, or 500 per 100,000 below the level of any previous post-epidemic trough. [The rate of 700 was that in 1935.] In Stockholm according to recent figures supplied to the author by Dr. Einar Rietz, the Medical Officer of Health for that city, the trend of incidence of gonorrhœa has been steadily downward and has fallen to a point more than 60 per cent below the peak in 1918. Nelson attributes these declines to the provision of free treatment. In Massachusetts, where the problem has been seriously tackled on similar lines, clinic admissions after rising to a peak in 1932 have steadily declined, in spite of the continued economic depression tending to force people to resort to clinics rather than seek private practitioners. Notifications of the disease by private practitioners have also declined by 50 per cent. All this has been achieved without the help of the sulphonamides by the steady pressure applied by the State with the help of its thirty clinics. The author says, "If health officers will now put their shoulders to the wheel, the load must begin to move." The article is illustrated with a number of charts illustrating the author's statistical data.

L. W. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 6.

Reviews.

FOOD VALUE CALCULATOR. Issued by the Research Laboratories, Vitamins, Ltd., Hammersmith, W.6. Price 2s. 6d.

This ingenious Calculator has been designed to act as a ready reckoner for estimating the food value of the different items of the diet.

The publishers specifically state that its use is mainly in large scale dietary surveys, where the use of the round figures set out in the Calculator will not lead to any significant inaccuracies.

The Calculator is circular in shape and constructed of cardboard. The food-stuffs are divided into nine groups, and by an arrangement of revolving discs, the protein, calorie, calcium, iron, and vitamin A, B, and C contents of any of the foods in common use in this country can be read at a glance for one ounce or for six multiples of this.

The values of the different nutrients correspond with those given in various food tables in standard use in this country at the present time and the Calculator can be thoroughly recommended to all whose duty it is to assess the nutritive value of the diet in large scale surveys.

I. A. A.

DISORDERS OF BLOOD PRESSURE. By Various Authors. Edited by Sir Humphry Rolleston, Bt., G.C.V.O., K.C.B., M.D., F.R.C.P., and Alan Moncrieff, M.D., F.R.C.P. "The Practitioner" Booklets, No. VI. London: Eyre and Spottiswoode (Publishers), Ltd. 1942. Pp. ix + 83. Price 6s.

This small book, based on contributions to *The Practitioner*, contains six articles by different authors dealing with various aspects of blood-pressure.

Professor Pickering's introductory paper gives an admirably clear and concise review of the significance of high blood-pressure in general. Dr. Shirley Smith describes how to measure the systolic and diastolic pressures and explains their interpretation relative to life assurance examination. Though the sphygmomanometer is popularly regarded as an instrument of precision, the results obtained by different observers in the same patient often show surprising discrepancies. This arises partly from errors of technique and partly from the difficulty of obtaining basal conditions on the part of the patient. Dr. Shirley Smith's directions for estimating blood-pressure are based on the recommendations of expert committees and most of us could refer to them with profit.

Dr. McAlpine's article deals with the cerebral complications of arterial disease and includes a résumé of his own studies of hypertensive encephalopathy, a condition still frequently confused with uræmia.

Professor Thomson describes the renal changes associated with benign and malignant hypertension. The differential diagnosis from nephritic hypertension is adequately discussed. Little reference is made to recent work on experimental

renal hypertension, perhaps because its clinical significance has yet to be determined.

Treatment is dealt with by Dr. John Hay and, if his simple directions were to be followed by the profession at large, many patients with high blood-pressure would be happier, and some would be healthier not to mention wealthier. If the concluding article on hypotension by Dr. Starling seems by comparison the least satisfactory, this is because it reflects the relatively meagre knowledge that is as yet available on this aspect of blood-pressure.

It would be unfair to criticize a booklet of this size on grounds of omission, yet the absence of a section on hypertensive heart disease is noticeable. Heart failure is surely the most frequent cause of death in high blood-pressure, and is actually more important than either its cerebral or its renal complications. This omission might with advantage be remedied in any future editions. As it stands, however, the booklet can be recommended to all who regularly use the sphygmomanometer.

DISEASES OF THE NOSE, THROAT AND EAR. By L. Simson Hall, M.B., Ch.B., F.R.C.P.E., F.R.C.S.E. Edinburgh: E. & S. Livingstone. 1941. Pp. xvi + 446. Price 15s. net.

The appearance of a second edition of this informative and stimulating book in the space of four years indicates its sterling value to a wide circle of readers.

The book has retained its previous high standard, is concise, clearly printed and well illustrated. It offers a quick and comprehensive reference for the busy practitioner and is sufficient in itself for the final year student.

Mr. Simson Hall's many years in general practice are reflected in his wide knowledge and understanding of the values of early signs, differential diagnosis and treatment of diseases.

The value and dangers of chemo-therapy are stressed, particularly in regard to acute otitis media. The technique of minor surgical procedures in the ear, nose and throat is well illustrated and carefully described. Details of the major surgical aspect have not been omitted but are without unnecessary detail. The chapter dealing with endoscopy stresses its significance and value. Many will welcome the clear description and method of investigation of the types of deafness and the functions of the labyrinth.

This book should prove a source of sound knowledge and a genuine guide in the subject of oto-rhino-laryngology.

J. L.

ILLUSTRATIONS OF BANDAGING AND FIRST AID. Second Edition. By Lois Oakes, S.R.N., D.N. (Leeds and London). Edinburgh: E. & S. Livingstone. 1942. Pp. viii + 256. Price 4s. 6d.; de luxe 6s.

Bandaging and First Aid in hæmorrhage, and fractures are dealt with in over 300 excellent illustrations with instructions. There are frequent blank pages for notes.

As a guide this book can be strongly recommended.

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Journal
of the
Royal Army Medical Corps.

Original Communications.

BREATHING MACHINE SERVICE IN THE NORTHERN COMMAND,
INDIA

BY LIEUTENANT-COLONEL F. M. LIPSCOMB,

Royal Army Medical Corps.

AND

LIEUTENANT-COLONEL A. C. HARVEY,

Royal Army Ordnance Corps,

SECTION I.—HISTORY.

TWENTY-ONE cases of acute anterior poliomyelitis occurred among the military population of the Punjab and North-West Frontier Province during the years 1932 to 1940. The proportion of severe and fatal attacks was very high because a military population is predominantly adult and at this age the disease is apt to assume a grave form. The actual cause of death in nearly all cases was respiratory paralysis. Up till 1939 attempts were made to save such cases by manual artificial respiration performed by relays of orderlies, but without success. The cause of failure was exhaustion of the patient by lack of sleep, continued trauma about sixteen times a minute sometimes involving grave skin infection and difficulty of satisfactory feeding and nursing.

In 1939, at the instigation of Major W. A. D. Drummond, R.A.M.C., the Staff of the Ordnance Workshop ———, by a remarkable effort, improvised an "Iron Lung" in the course of a few hours but unfortunately the patient for whom it was made died a short time before it could reach her. The apparatus was used soon afterwards for another case; it kept him alive for several days but did not succeed in saving his life. This latter case was very severe and it is possible

that nothing would have saved him but it was felt that he would have had a better chance had the apparatus been more accurately controllable, with facilities for nursing, and had all arrangements for transport and treatment been in ready working order.

It was evident that two or three lives were at hazard every year because of the lack of efficient apparatus and well-organized arrangements. If this was so under the previously existing conditions of peace, how many more would be at risk when the great number of additional troops required for new war formations had assembled in the Command ?

It was decided first of all to establish a treatment centre at the British Military Hospital, ———, and get a fully automatic " Iron Lung " installed there before the poliomyelitis season (April to September) of 1940, and then to evolve a scheme for dealing with the problem in out-stations.

Thanks to the enthusiasm of Major-General W. H. Hamilton, then Deputy Director of Medical Services, Northern Command, and Major (now Lieutenant-Colonel) D. M. Reid, then Senior Ordnance Mechanical Engineer, ———, many difficulties were overcome and the machine was ready for the first case of 1940.

At that time " Nuffield Lungs " had not reached India nor were specifications of any electrically operated machine available. We were left free to develop our own ideas.

The Scheme.

The Medical Research Council's Report on Breathing Machines, 1939, shows pretty clearly that the best results in cases of respiratory paralysis due to anterior poliomyelitis are obtained only when the patient is treated in a fully equipped machine manned by specially trained personnel familiar with its working and with all the details of management. This is not difficult to contrive in England, where distances are short and transport facilities good, but in North-West India special arrangements are needed to cope with slower communications which may be interrupted by climatic conditions or even enemy action.

Working on the assumption that dangerous respiratory paralysis seldom develops until several hours after grounds for a diagnosis of acute anterior poliomyelitis have become reasonably clear, the following scheme was evolved.

A large fully automatic machine was to be installed in a specially equipped ward in the Isolation Block of the British Military Hospital, ———. Light portable machines operated by hand were to be located at smaller stations to convey patients to the central installation. The procedure to be adopted was that, as soon as acute anterior poliomyelitis (or other disease likely to cause paralysis of respiratory muscles) was diagnosed, the patient was to be transferred to the central installation by the most expeditious means available—motor ambulance, train, troop-carrying aeroplane or even light lorry. He was to be transported in a portable machine : if respiratory paralysis was already established the machine could be operated throughout the journey ; if it had not developed, the patient would be in a position in which the aid of artificial respiration could be applied immediately without further disturbance should it be required.

The original scheme was modified by the subsequent arrival of a Nuffield Lung from England. This was located at the British Military Hospital, ———, to serve the Eastern part of Northern Command, while the one at ——— served the Western part.

Apparatus.

At the time when it was decided to build our own machines we had, as stated above, no diagrams, pictures or drawings to work upon. All we had was the recollection of a Drinker machine which one of us had seen in operation in England. The engineering problems were solved and a practicable machine was evolved by the staff of ——— Arsenal. A periodical containing some pictures of iron lungs arrived while work was in progress but unfortunately it gave no details of machinery, measurements or construction.

(a) *Automatic Machine.*—As this was the core of the scheme, it was taken in hand first.

The task of the engineers was to provide an airtight box inside which the atmospheric pressure could be rhythmically lowered by at least seven inches of water allowing a margin for accidental leaks ; to design a comfortable bed on which the patient could be put into the box with his head protruding outside ; and to furnish air seals round his neck and round the end plate which must be removed to allow him to be put in and taken out ; in addition, means had to be found of controlling and regulating pressures and speed of operation and of giving access to the patient inside the machine. Lastly an alternative means of hand operation had to be included for use in case of failure of current or other breakdown. A description is given in Section II below of how these problems were solved. The machine, when finished, was found to have a strong resemblance to the Drinker Iron Lung.

A difficulty which subsequently arose during operation in the hot weather at ——— was that of cooling the patient inside the machine. In hot dry weather remarkably effective cooling can be obtained by playing an electric fan on a wet sheet placed over the machine but when the humidity is high this method is comparatively useless. The machine has now been air conditioned by forced circulation in a closed circuit of a portion of the air contents of the box through a device for cooling in the hot weather or warming in the cold weather.

(b) *Portable Machines.*—The machine described above, although it *can* be transported in a lorry, is a great weight and awkward to move and cannot easily be taken from place to place. In pursuance, therefore, of the policy outlined in the scheme it was decided to design and build portable first-aid machines in which patients could be brought from out-stations to the central installation. The desiderata were that the apparatus should be easily portable like a stretcher with the patient inside, capable of being accommodated in a train, in a motor ambulance, or in an aeroplane and be operable during transit. It was felt that these considerations outweighed provisions for automatic operation and nursing the patient in the machine.

The result achieved is given in Section II.

(c) *Personnel.*—The team found necessary to work the automatic machine

consists of 1 Medical Officer, 1 Assistant Surgeon, 1 Nursing Sister, and 4 Orderlies. The Medical Officer's duties are general management of the case, supervision of the machine and its working and responsibility for the proper performance of their duties by other members of the team. He is assisted by the Assistant Surgeon who relieves him as required. Either the Medical Officer or the Assistant Surgeon is always present. The Nursing Sister is concerned with the comfort, nursing and feeding of the patient and is assisted by the nursing orderlies. Of the nursing orderlies two must always be present in order to effect rapid change over from electrical to hand operation in case of breakdown. Every member of the team must be fully conversant with the theory and practice of his or her duties and know what to do and how to do it without delay. The scheme of training consists of (i) theoretical instruction in the physiology and mechanics of respiration, the causes of failure of respiration due to paralysis of respiratory muscles and the way in which the breathing machine produces artificial respiration, (ii) demonstration of the working of the machine and (iii) practical operation of the machine by each member of the team until he is proficient. One of the orderlies is instructed in maintenance and is responsible that the machine is always ready for use.

Four teams are trained for the automatic machine. This allows of relief of individual members during operation and insures as far as possible that the hospital is not left without trained personnel owing to sudden movements demanded by military exigency.

Teams are trained for the portable machines on the same lines but on a basis of two teams for each apparatus.

Results.

Up to the time of writing, three patients have been brought to the central machine.

Case 1.—A British Officer brought from ——— (105 miles) by air. The paralysis included abdominal muscles, shoulder girdle, cervical sympathetic and slight affection of the diaphragm. He was able to maintain adequate ventilation by his own efforts but it was apparent that very little extension of paralysis would place him in jeopardy. He was put in the machine where he spent twenty-four hours but, fortunately, by the end of that period the peak of the disease had passed and it never became necessary to switch on. It was noteworthy what a calming effect was produced by the knowledge that should his breathing become too difficult he would receive immediate aid by the mere act of turning a switch.

Case 2.—A British Officer transported by road from ——— to ——— (64 miles) and by air from ——— to ——— (366 miles). Respiratory embarrassment steadily increased during the flight especially at altitudes above 2,000 feet, and by the time the patient reached ——— (1 a.m.) he could only just breathe by means of accessory muscles. Exhaustion from continued effort to breathe, lack of sleep and difficulty in taking food was becoming dangerous. He was placed in the machine, the motor was switched on and pressure and rate adjusted. Fifteen minutes later he went to sleep and slept comfortably for six hours. Subsequently he was removed from the lung for increasing periods, beginning with nine minutes on the first day, until at the end of a month he was able to discard the machine altogether. The latter worked without a hitch during the whole of this period. The patient, though paralysed in his legs, was able, five months later, to

wheel himself about, to feed himself and to use a typewriter. He will certainly be capable of useful work even if no further recovery of power takes place.

Case 3.—A British Other Rank transported by motor ambulance from ——— (62 miles). Paralysis included abdominal muscles, intercostal muscles and left diaphragm. He had a cold before the onset of the poliomyelitis and this added respiratory infection to his troubles. He actually was able to maintain adequate ventilation unaided except during exacerbations of the lung infection. At these times he was helped by a few hours in the breathing machine. He is now able to get about. It is likely he would have done so without the aid of the machine, but its availability made the management of the case easier.

The portable machines are able to control respiration in a healthy patient but up to the time of writing they have not been used for a case with actual respiratory paralysis.

SECTION II.—THE MAIN POWER-OPERATED BREATHING APPARATUS ("IRON LUNG") MADE IN ——— ARSENAL.

General Note.

This power-operated breathing apparatus is not intended to be portable in the usual sense of the word, and was designed to cope with every reasonable variation of conditions of nursing of the patient. It is intended to work for long periods with the minimum of maintenance.

A.—General Description.

The apparatus consists of a sheet metal box body resting on a rectangular angle-iron frame, the suction plant being housed within the frame.

The bellows which supply the necessary suction are fixed to the underside of the box body.

B.—Detailed Description.

(i) *The Box Body.*—This is of all-welded construction and is made of 16 S.W.G mild steel sheet welded to a suitably braced frame of $\frac{3}{4}$ by $\frac{3}{4}$ inch angle iron, the overall dimensions being 6 by $2\frac{1}{2}$ by $2\frac{1}{2}$ feet. The two sides slope from 1 foot 8 inches from the base towards the flat top at an angle of 45° to the top, thus making the cross section of the box approximate to half a hexagon based on a rectangle.

The foot end of the body also slopes from 1 foot 8 inches from the base at an angle of 15° to the top.

The body has the following apertures for nursing purposes :—

(a) Two windows, one on each side, of oval shape approximately 14 by 7 inches, let into the sloping portion of the sides. Non-inflammable "celluloid" $\frac{1}{8}$ inch is used in place of glass.

(b) On one side a large aperture of approximate size 1 foot 6 inches by 9 inches, large enough to admit a bed-pan, its centre point being 3 feet 9 inches from the headend of the box.

(c) Four hand holes. These have "port-hole" type covers, which open to disclose a sorbo rubber muff through which the arms of the attendant can be thrust without causing an air leak. The hand holes are disposed at the following

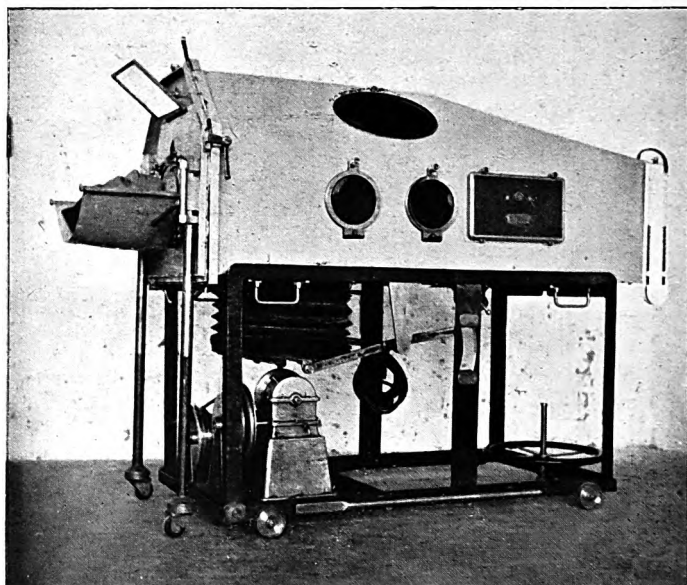


FIG. 1.—Power-operated Breathing Apparatus.

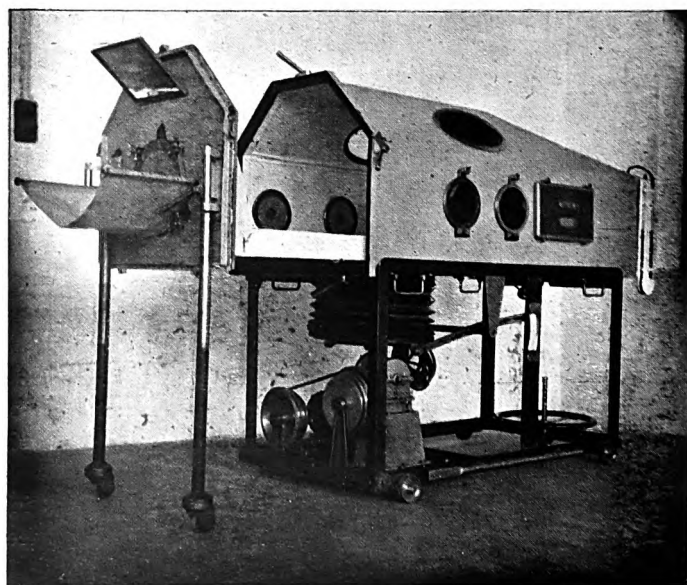


FIG. 2.

distances from the head end of the box ; on one side 1 foot 8 inches and 2 feet 8 inches, on the other side 7 inches and 1 foot 10 inches.

Also fixed to the box body are the following :—

(a) The bellows, which are of corrugated cylindrical design of 1 foot 8 inches overall diameter, fixed to the underside of the body at a distance of approximately 1 foot 6 inches (centre) from the head end of the box. These operate through a hole in the box so that any draught impinges on the underside of the bed.

(b) An equalizing valve, which is a simple hinged disc flap valve, fixed to the underside of the box approximately 3 feet 8 inches from the head end. This is to obviate any tendency to raise a positive pressure and an adjustable weight is provided on an extended arm so that balance can be varied if desired.

(c) A pressure adjusting valve mounted at the foot end of the box, this being a simple circular disc with ports so arranged that it can be rotated to allow any leakage desired. This is the means of adjustment of the negative pressure in the body and the disc is attached to an arm moving in a graduated arc.

(d) A glass tube type manometer mounted on the side of the body at the foot end.

(e) A lamp is fixed at the top of the body on the inside and is operated by an external switch.

(f) Five quick-action clamps for securing the head plate (*see* (ii) below).

(ii) *The Bed Frame and Head Plate.*—The bed frame is of ply-wood supported on two 16 S.W.G. mild steel sheet box section girders. A rubber mattress is used on top of the plywood. The girders have wheels set inside which run on runways in the box body.

The head plate which, when the apparatus is closed forms the head end of the box body, is welded to the bed frame girders. This plate has a hole cut, on its centre line and about 11 inches from the base, of 10 inches diameter, where the "neck ring" is held. The neck ring is of $\frac{1}{2}$ inch thick "Sorbo" or "Latex" rubber sheet with a collar to fit over the patient's neck. The following diameters of collars are used, these sizes being based on measurements taken of a large number of patients at the B.M.H. ——— ; 3 inches, $3\frac{1}{2}$ inches, 4 inches and $4\frac{1}{2}$ inches.

It is found that a padding of cotton-wool is sometimes necessary between the rubber collar and the patient's neck. The collar, about $1\frac{1}{2}$ inch wide, is vulcanized to the Sorbo sheet.

A head rest of canvas, stretched between two rods, is provided outside the head plate and a mirror is fixed on a trunnion over the patient's head to enable him to see what is going on behind him.

The head plate is clamped to the body by 5 wedge type quick acting clamps, a good sealing action between the plate and the body being obtained by a continuous rubber tube fixed in a recess in the body.

The head plate also carries on its outside two legs adjustable for height which run on castors on the floor. These support the bed when pulled out of the box.

(iii) *Angle-iron Frame*.—This rectangular angle-iron framework supports the box body and also carries on a platform the actuating mechanism.

The whole main frame is pivoted at the head end on a sub-frame and an elevating screw with a large hand wheel is provided at the foot end so that the foot end can be tilted upwards. The sub-frame, which forms the base of the whole apparatus, runs on four small wheels for purposes of movement.

(iv) *The Mechanism*.—This consists of a $\frac{1}{2}$ H.P. A.C. single-phase electric motor running at 1,440 r.p.m. driving, through a "Vee" belt on cone pulleys, an 80 to 1 worm gear running in an oil bath. The worm wheel shaft actuates a disc crank the connecting rod of which is coupled to the base of the bellows. The stroke of the crank is adjustable up to a maximum of 6 inches. The centre line of the bellows is immediately above the centre points of the crank.

An approximation to parallel motion of the bellows is obtained by a rocking lever pivoted at one end on the frame and at the other at the connecting pin on the base of the bellows. This rocking lever has also an extension beyond the frame pivot to take a lever for hand operation, should the electric current fail.

When hand operation is used the crank is moved to top dead centre and a locking pin is turned which leaves the connecting rod free to slide up and down in the guide.

The cone pulley ratios, driver to driven, are $\frac{10}{9}$, $\frac{1}{1}$, $\frac{9}{10}$ and $\frac{2}{3}$. Thus the suction rates obtainable in the body are 20, 18.1, 16.2, and 12.1 per minute.

(v) *The Bellows*.—These are of cylindrical shape, approximately 1 foot 8 inches diameter, made after the fashion of a concertina. The material is leather with a wood base. The shape is maintained by a series of wire rings tacked to the inside of the leather. The top of the bellows is fixed to the base of the box body and exhaustion is through a 4 inches diameter hole in the box body. The bellows are designed for a maximum stroke of 6 inches, thus giving an air displacement of approximately one cubic foot.

(vi) *Control of air temperature*.—The use of this apparatus in ——— in hot weather proved the necessity for some form of temperature control device. The shaft of the motor, at the opposite end to the cone pulley drive, drives a small 4-bladed propeller type centrifugal fan through a "Vee" belt. This draws air, in an entirely separate circuit to the suction mechanism, by a pipe from the box body, and exhausts it through a radiator box back to the box body. The radiator box is a double bottomed tin plate box fitted with a drain cock into which ice, freezing mixture or hot water can be placed. The shape of the box is designed to present a large area to the air going through the double bottom. The capacity for liquids of the box is about $2\frac{1}{2}$ gallons.

The fan is very small, the circle described by the tips being 3 inches diameter, and is designed to change the air in the box body about every fifteen minutes. Its speed is stepped down to 360 r.p.m. A butterfly valve is incorporated at a convenient point in the air pipe to allow flow to be adjusted.

C.—Operational Details.

(a) A negative pressure of up to 13 inch water gauge is obtainable with this apparatus. This is far more than is usually required, the normal figure being about 7 inches. This wide margin, however, allows the apparatus to continue in opera-

tion with possible minor leaks. The adjusting valve allows this to be reduced down to almost zero.

(b) The momentary positive pressure on change of stroke of the bellows can be reduced by the equalizing valve to less than $\frac{1}{4}$ inch water gauge.

(c) If desired to suit a particular case the apparatus can be used to work with a combination of positive and negative pressures by simple adjustment of the pressure adjusting valve and the equalizing valve.

(d) The speed of stroke is variable to speeds of approximately 20, 18, 16 and 12 per minute, by shifting the "Vee" belt on the cone pulleys. This operation takes only a few seconds.

(e) The change from motor to hand operation takes only a few seconds. The detachable handle for hand operation is housed in spring clips on the frame when not in use.

(f) The manometer is filled with a mixture of water and red ink.

(g) A switch and fuse for the motor are situated on the frame and a long flexible cable carries the current from a convenient wall plug.

(h) The frame is enclosed by curtains running on brass rods.

(i) The apparatus is very silent in operation, a great advantage from the point of view of the patient, and can run for several weeks without attention other than occasional application of oil to bearing surfaces and the use of a little dubbin on the leather bellows to keep them pliable and airtight. The oil bath in which the worm and worm wheel run only needs replenishment at very long periods.

THE PORTABLE TYPE BREATHING APPARATUS ("IRON LUNG").

General Note.

This apparatus was designed purely for use as a "FIRST AID" measure for transporting patients by aeroplane, motor vehicle or train to the main apparatus. Accordingly it is very simple in design and only essential features have been incorporated.

A.—General Description.

The apparatus consists of a ply-wood box body with the bellows mounted on the sloping top at the foot end of the box. A stretcher type bed is fixed to the head plate. The box body is mounted on two stout bearers which terminate in stretcher handles for transport.

B.—Detailed Description.

(i) *The Box Body.*—This is of rectangular section, and is 6 feet 6 inches long by 2 feet high by 2 feet 3 inches wide (external). The top slopes towards the foot from a point 3 feet 6 inches from the head end at an angle of about 22° to the horizontal. This portion takes the wedge-shaped bellows.

The box is of 3-ply wood screwed, with red lead jointing, to a hardwood frame having at its base two long bearers which extend beyond the box at each end to form stretcher handles.

Only one aperture is provided in the box for nursing purposes, this being a hinged window-type frame 1 foot 6 inches by 10 inches mounted on the horizontal portion of the top. The frame is of mild steel and holds a window of

$\frac{1}{8}$ inch thick non-inflammable "celluloid." A seal is obtained on a "sorbo" type rubber seat on the box and the frame is held closed by two hand screws.

The other attachments to the body (apart from the bellows) are :—

(a) A leather flap valve mounted on top between the bellows and the window port. Four 1 inch holes in the top of the box body allow for outlet of air and the soft leather $\frac{1}{8}$ inch thick is held by a wood batten so that it covers these holes when suction occurs. A good seating for the leather flap is provided by a thin mild steel sheet.

(b) A pressure control valve, mounted on the side of the body, this being

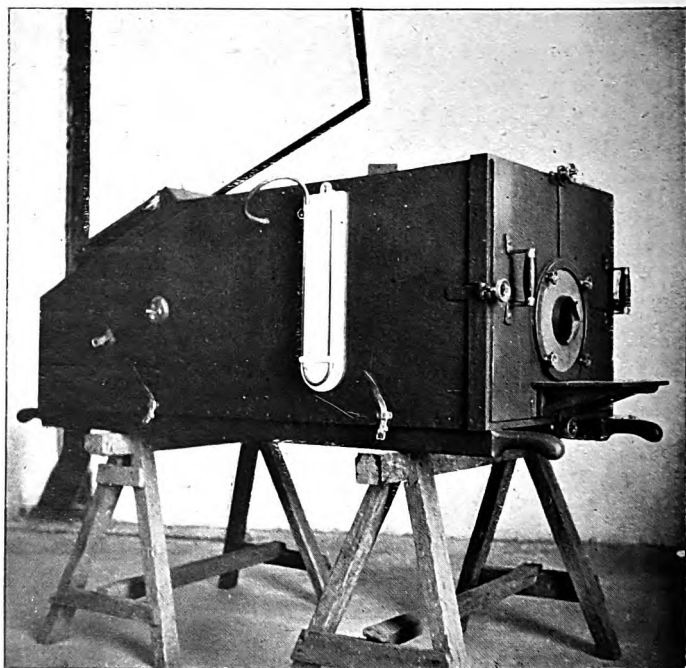


FIG. 3.—Portable Breathing Apparatus.

merely a rotative disc with ports cut in it. This is the means of pressure adjustment.

(c) A simple glass tube manometer.

(d) Leather straps and wood blocks to hold the operating handle when not in use.

(ii) *The Head Plate and Bed Frame.*—The bed frame consists of two hardwood bearers, similar to stretcher side bars, with canvas stretched between. These are fixed to the head plate of $\frac{1}{2}$ inch seasoned teak and reinforced with metal stays. Handles are fixed at the foot end of the bed for lifting.

The head plate is beaded with steel beading at its edges to form a good joint on a rubber joint tube covered in thin cloth housed in the box body.

The neck ring arrangement is very similar to that of the power operated appa-

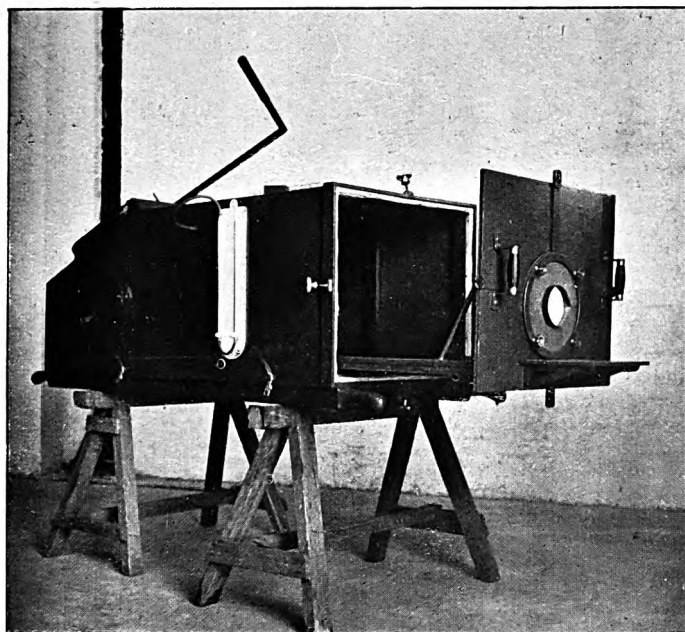


FIG. 4.

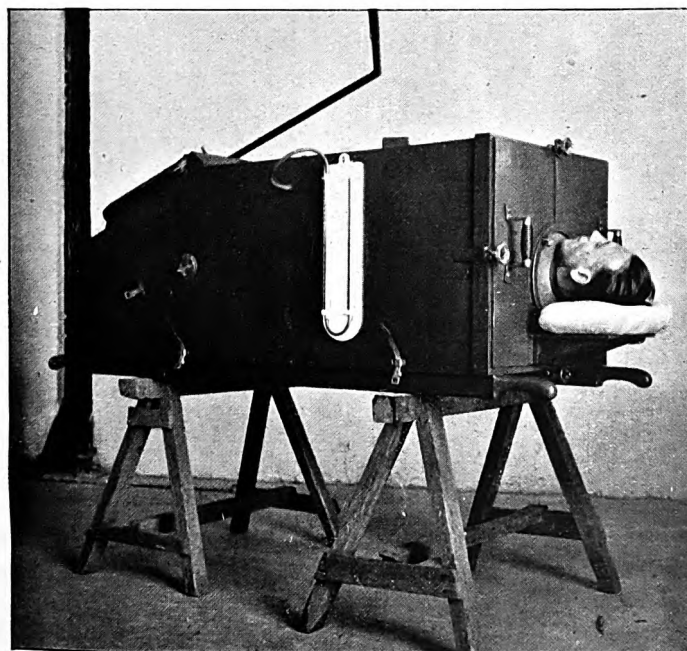


FIG. 5.

ratus already described above but only two rubber collars are provided of 3½ inches and 4½ inches diameter respectively.

A wood head-rest to hold a pillow is fixed to the outside of the head plate and two handles for drawing out the stretcher bed are also attached.

The head plate is held to the body by four large hand nuts on hinged screws attached to the body. These screws run in reinforced slots cut in the head plate.

(iii) *The Bellows*.—These are of leather and are wedged shaped, the hinge being on top of the box body 2 feet from the foot. The maximum stroke of the bellows is about 9 inches measured at the foot end and they are 2 feet wide with a small radius at the corners of the foot end.

The leather is reinforced at the folds by wire tacked inside. The top of the bellows is ½ inch thick hardwood and carries two brackets to hold the operating handle. The operating handle is a tube 3 feet 6 inches long with a further bent portion at about 55° of 1 foot 9 inches long. It can be fixed in the brackets on the bellows top by removable pins (held for security on small chains) so that it either extends over the box (for operation in confined spaces) or behind the box.

C.—Operational Details.

(a) A negative pressure of up to about 7 inches to 8 inches water gauge is obtainable. This was chosen as a good average figure after study of the Medical Research Council's Report (1939) on the subject as it appears to be generally accepted that a negative pressure of 18 cm. water gauge (approximately 7 inches) is the most useful average, at any rate for early treatment. This can be varied to any pressure down to zero by means of the adjusting valve.

(b) Momentary positive pressure on change of stroke is almost zero.

(c) A correct speed of stroke is easily maintained by the operator who merely has to suit it to his own breathing. In the early stages various forms of gearing for driving the bellows were tried out but were discarded chiefly because of the difficulty of maintaining an even stroke. An average operator can keep the apparatus going for about an hour at a time but it is desirable to have a change at each half hour. Two men employed in this way, alternately resting and operating, can keep going for a very long time.

(d) The manometer is similar to that used on the mechanically operated apparatus.

(e) The only maintenance required is occasional treatment of the bellows and the leather flap valve with dubbin to keep them soft and pliable.

GENERAL REMARKS.

It must be realized that the two types of apparatus described in the foregoing pages were evolved after considerable experiment and trial. It is not claimed that there is anything novel in their mechanical construction or principles but they were produced more or less from first principles with very little information to help us.

We were naturally limited to material available in India and to the available manufacturing facilities.

They can both, undoubtedly, be improved, and several minor changes have already been made as a result of experience in their operation.

MAN-MANAGEMENT.

A Lecture by

LIEUTENANT-COLONEL R. A. MANSELL, O.B.E.,

Royal Army Medical Corps.

" Let us then study the soldier . . . "

" MAN-MANAGEMENT "—some people like this title, some don't—we haven't time to argue about that now. Some don't even know what they should understand by it.

In the past we got used to the Veterinary Service talking and writing about "Horse-management." They built up a very clear and useful science under this title so that their art in the practice of it produced results which made its value clear to all. Later we invented the term "child-management" and have attempted to teach and to practise along the same lines in relation to children. These have seemed perfectly rational and natural terms to use. I suppose everybody is prepared to consider managing an animal—until they meet a mule; and most people, until they have to try and do it, are satisfied that a child can be managed: but they jib, straightaway, at the idea of managing a fully grown man and a soldier to boot. It isn't until one realizes how like soldiers in the mass are to little children that one appreciates that there is, really, a rightness in the term. Few if any groups of individuals, except perhaps incarcerated criminals and the mentally defective under supervision (and we do strive to "manage" them) enjoy, as soldiers do, the child's freedom from the necessity to worry about any details of their daily life save only that they learn their lessons and, so far as seems essential to them in order to escape punishment, obey their elders and betters and those set in authority over them. If we can accept this line of thought at all we are prepared for the suggestion that, if soldiers, in mass, may be regarded as children, we, in detail, must consider ourselves as their parents. We can go further, if you like, and think of the warrant officers and non-commissioned officers as their governesses and nurses—though I suggest that we might keep that thought to ourselves. And then we put the unit medical officer in his place as the family doctor. Here it is worth while reminding ourselves that the continuity and the personal knowledge of the families under his care, which results from the permanence of residence of the family doctor, and which is so essentially valuable both to him and to his patients, has to be provided for our soldier "children" by means of the medical entries in A.Fs I. 1220, medical history sheets, A.Bs 64, and the like; and that these have an importance to both parties, and especially to those about whom they are written, out of all proportion to the somewhat slender care and thought which are often given to them.

There isn't time to deal with the whole of such a subject as this thoroughly in

one short lecture. We can only take a few points here and there in the soldier's life and day and remind ourselves what are the sorts of things that we—his parents—can, and should, do about them. I can't recommend you to many, or any, books: there doesn't seem to have been much written about this subject specifically as such. But you should all have, and know almost word for word, the official pamphlet issued in February of last year—"The Officer and Fighting Efficiency": that's just full of real wisdom in this matter—the first half of it, at any rate.

The first real difficulty which the soldier meets is the whole difference which there is in behaviour, values, surroundings, almost everything, between civil and military life. In the training of the recruit in peace much thought and time can be given to this and it is handled by selected officers and N.C.O.s. But in war there cannot be so much selection, nor is there time to spare; so that we must realize, all the more, the strain under which many of our men are constantly living from this point of view alone. Purely on the sanitary side too few of us, I think, really consider, in our civilian life, what a deal of trouble we are saved by those who think and work for us. And it is not until we find ourselves in camp or on active service that we appreciate to the full the blessings of a plug which can be pulled or of a dustman who calls regularly. Adaptation to this kind of life is unbelievably difficult for some: indeed to many it is only prolonged and bitter experience which forces home the truth that in these circumstances the evil that men do lives with them. It is a profound biological truth that any living animal, from the lowliest up to the master man, will perish rapidly as the result of the accumulation of its own refuse unless it takes active steps either to dispose of its "waste products" or to remove itself from them. And it is, perhaps, salutary to reflect that the more lowly forms of life—the vegetables—do not suffer from this disability; indeed, on the contrary, they flourish the more as the result of it.

It is worth while pausing to remind ourselves that there is a type of mentality which can not only busy itself in these so essential conservancy duties but even take a pride in their proper performance. Men are to be found who can make a life job of the burning of manure and like the business. If we can get such a man into our sanitary squad we can rest assured that the work will be well and thoroughly done. But it is also worth while reminding ourselves that there are, equally, many men, and especially now in our present Army, to whom such employment may be a source of such mental trauma as to leave not only the work ill-done—and we know how dangerous to others that may be—but also themselves definitely decreased in efficiency as members of the military machine. There is no need to have round pegs in square holes if we will but take a little trouble to measure men up.

Has it ever occurred to you that the one thing which the private soldier has not got and cannot have—unless we give it to him—is (paradoxically enough as the words go) privacy, even for a few minutes, in which to lead his own private life? There is an enormous value, from this point of view, in the reading or writing room, the quiet room, of the Institute, the Canteen or the Club, where a man can sit and think to himself, or even just sit; where he can write and read

his letters to and from his home, his wife, his children, his girl. Incidentally, do you know who, and how many, these are in relation to the men under your immediate command—your children? You ought to, you know. And what their worries are: God knows we all have enough in these days; but we, perhaps, can deal with ours, and get help in them, more easily than the private soldier can unless we ourselves go out of our way to help him, to learn his personal life and to listen to, and occasionally advise, him in his troubles. Though we may not be able to give any active help, it's amazing—and we each know it ourselves—what a relief it is to be able to get a worry off one's chest before someone to whom we look up and who will listen sympathetically. Through all the discipline in the world that can be done and only strengthen the discipline in its doing. After all, as a general rule, we are not asked to make any world-shaking decisions; for it's the little worries that give the worst trouble—silly little things which, were we at home with the family and face to face with them, would be brushed aside with scarcely a thought but which, when we're away, prick and prick till they make a wound, the origin of which often we can barely remember until we have talked the whole thing out with someone who will listen. This sort of thing was, I am told, well exemplified in those of our men who were brought back from Flanders broken, at the time, with what in the last war we rashly called "shell-shock." Essentially at the back of most of those men's trouble there was a worry, often so small and, when revealed, in itself so silly as to be with difficulty recognizable in quieter times as a real worry at all. But, added to other and greater stresses, it became the counterpart of the proverbial straw on the long-suffering camel. Men worry over missing just that letter which was to tell them whether little Dick did catch the measles from Nellie—"Never strong in his chest, was Dick." The proof of these things was a recovery rate unexpectedly high in comparison with previous similar experience.

Talking about letters: how long does it take to distribute letters in your unit? Every man knows when the post corporal gets in with them; but does the man who is waiting for important news—and all news of his family is important in these days—does he get his letter with the promptitude with which we get ours in the Mess, or does it take hours to reach him through many inquisitive or uninterested hands? It is a point worth looking into.

In your unit can a man say, as he enters the dining hall, "Brown stew and rice pudding—must be Monday"? Or, conversely, because it is Monday does he know that he is going to hate his dinner because it will be brown stew and rice pudding? With all the difficulties which there are in these days in the matter of rations and the arrangement of diet sheets, both from the issue and the receipt point of view, isn't it just as easy to plan our dietaries, so far as we can at all, on an eight or ten day basis as on the customary seven, so that a man can't tell what day of the week it may be by what he sees on his plate, or vice versa. Monotony has killed almost as much good food as have cooks, and it is worth while taking any trouble to escape from it. Listen to Wavell [1]:—

"Discipline apart, the soldier's chief cares are: first, his personal comfort—i.e. regular rations, proper clothing, good billets and proper

hospital arrangements (square meals and a square deal, in fact); and secondly his personal safety—i.e. that he shall be put into a fight with as good a chance of victory and survival as possible. Guns and butter, in other words. And it may be remarked," he continues, "that Russian moral in the late war broke through lack of guns, German lack of butter."

There are now, and the peculiar conditions of modern war make it necessary that there should continue to be, many small, isolated garrisons scattered over the countryside where men have to remain often on almost continuous hours of duty for long tours at a stretch. Many of these posts are located so far out in the country that there is little possibility of intercourse with the world at large, even if there were the time or opportunity for it. Our defence, and the defence of our families, depends very greatly on the men in these positions. Now people like you and I, blessed—we may suppose—with a reasonable degree of education, are able, to some extent at any rate, to relieve ourselves of the monotony of such situations: we have the ability and the training to find our recreation in our surroundings and even in ourselves. But the man of little or no education has not this ability: he has not even the possibility, unless we help him. Many of us may find it difficult to appreciate the outlook of a man recently relieved from such a situation whom one of his officers met the next evening in the town. To a casual inquiry as to how things went the man replied, "Grand, Sir, I've been having a good walk round and I haven't seen a blade of that bleeding grass in over an hour." And if you haven't met before the objection of the slum child to the country—that you can't play hopscotch on grass—you can't begin to realize the strain of the terrible monotony of these places on the uneducated townsman. I've been laughed at time and again for the suggestion, but I continue to make it because I know it has worked, that you can relieve this monotony for these men, and therefore improve their fighting efficiency, by teaching them the simple arts of the countryside—even to bird-watching and the collection of wild flowers.

A great many of us are suffering, or think we are suffering, from the monotony of things at the present time. Training—training—training; move—move—move; same sort of thing week after week; and no fighting, which was what we thought we had been brought into the Army for. We are apt to forget—and if we do so, how much more do the men—how long it really does take to make a soldier fit to win a modern war. And we are very apt to forget, also, that Hitler once boasted that he would defeat the French army by not attacking it—by letting it rot, so to speak, in its own juice. Can we say that he did not do just this thing? We must not go that way.

As a relief from the monotony of mere training, games have an inestimable value, apart altogether from their importance in the building up of a unit's solidarity; but, of course, as many men as possible must play them—and as many officers, with the men, as have not reached the years when such exertions are not really good for their continued health. There is a time in life when it is by far wiser to watch such activities than to take active part in them. Even at that time one can watch, criticize and encourage. It is rather surprising how many sports grounds one can visit and see men playing, and playing hard, without ever an officer even looking on. You do realize what a difference the personal interest of an officer does make to all of the men's activities, don't you—even his games?

And how he does appreciate that an officer should play games with him ? He's not a stern critic ; he realizes just as fully as do you and I that everyone cannot be first class, and that the mere fact that one is an officer does not necessarily mean that one is unbeatable with bat or ball. It is the sharing of things with some one to whom he looks up that he values. And, though it may sound strange, it is the fact that an officer can, and does, share things with his men which does keep him, in their eyes especially, above them as someone to whom they look up and to whom they continue to look up even in the direst emergency. I venture to suggest that it is just this ability to share our men's recreations and pleasures, equally with their trials and troubles—a condition which has always, more or less, been a basic part of British soldiering, and is rather peculiar to it—which has accounted for the success, both in victory and in defeat, of British arms. Don't let us forget the trials and troubles whilst we're thinking of games. I have seen a battalion on the march with the men in their plain battle dress and full equipment and their officers wearing waterproofs and overcoats ; true it was a miserably damp, cold day ; but that is no reason why any officer should advertise to his men, and to the world at large, that he is less able or prepared to endure such minor discomforts than they are.

You all know the value of sleep and the importance which we attach to "nights in bed." When men have had to miss some or all of the sleep-time due to them you do understand that we are right in insisting that some, at least, of that loss should be made up to them from the point of view of giving their bodies and minds rest in which to make good, to grow and to repair breakdown. But has it ever occurred to you that this time of rest, the hours of sleep, is the one portion of the soldier's daily life which he has really privately, all alone, to himself ; and that sleep has an added and especial value from that point of view ?

We haven't time to go through the soldier's life in detail on these lines, but I think I've said enough for you to realize what I, at any rate, understand and mean by this matter of "Man-management." It is, after all, in the main a matter of details ; and what it really boils down to, doesn't it, is getting the best you can out of your men by doing the best you possibly can for them in all circumstances.

In the course of conversation with an officer recently I heard a point of view which is well worth while bringing to your notice. He told me that he had noticed one great difference between this war and the last ; and he wore on his battle dress the evidence that he had served with distinction both in the ranks and as an officer in that unfortunate disturbance and so might be held to be justified in comparing it with this in the matter in question. He said that in the last war the great majority of the officers whom he served under, and whom he met, were leaders ; whereas now most seemed to him to be drivers. I will suggest to you that, though a driver goes, normally, behind those whom he sets in movement, when it comes to the real trial and the bad spot, the driver of men is apt to get a shot in the back and the leader, though he be in front, to be carried through hell and back again with the job safely done. I have been asked, after making such remarks as this, whether I don't think, or wouldn't consider, that the present system of recruitment—conscription as against volunteering—doesn't call for the

driver rather than the leader type of officer. Honestly I fail to see why. Isn't the idea that no mere accident of birth—or breeding—let alone any man-made law, can alter the fact that “a man's a man for a' that” just one of the most important of those things for which we are now fighting? Does the fact that a man's actions are governed, in this respect, by the law of the land rather than being left to his own free-will make him any less of a human being or less deserving of being treated as such; or, further, less likely to respond to such treatment?

I put it to you, as a broad general statement, that if you study history—and biographies as the most interesting, and possibly the best, way of doing this—you will come to the conclusion that the one characteristic which is common to all great leaders, to all really great soldiers, has been not a knowledge of tactics, not a skill in strategy, not even an ability to deal with politicians, but simply an intense understanding and an intimate knowledge of the private soldier. John Buchan [2] has put this supremely well in writing of Julian Byng.

“There can have been few commanders who were more rapturously adored by their men, and it was because of his rich understanding of humanity, what in Scotland is called ‘innerliness,’ and not because of any genial slackness, for he kept a tight rein on discipline . . . he talked to every man as if he were a blood relation.”

It is the result of this that we see in that magnificent retort of Wellington at Waterloo. That battle, you will remember, went badly for the British and their allies, so badly that the spectating diplomats who gathered round the supreme staff expressed, in plain terms, their conviction that it was high time that what could still be saved of men and material should be withdrawn before it was utterly smashed. They received the blunt reply—“My army and I know each other exactly, gentlemen. The men will do for me what they will do for no one else” [3]. And Wellington rode down into the fighting squares. True, if you like, that Wellington spoke few fair words to or of his soldiers; he may have blackguarded them to their faces, and behind their backs, in his orders and in his despatches; but he did insist, before all things else, that they had what we have already called their “guns and butter.”

Listen again to Wavell [1]:—

“The relationship between a general and his troops is very much like that between a rider and his horse. The horse must be controlled and disciplined and yet encouraged; he should, according to an old hunting maxim, be cared for in the stable as if he were worth five hundred pounds and ridden in the field as if he were not worth half a crown. And the horse knows not only by his own comfort whether he is being ridden well or badly but he knows if his rider is bold or frightened, determined or hesitating.”

I make no apology for continuing to quote to you; for where men have spoken or written in good and plain English the ideas which I want to put before you, then you should have their words rather than my halting prose. That their words live and continue to teach marks the value of a point stressed recently to us over the air—that

“the success of a leader is the degree to which he makes himself dispensable and teaches his disciples to do without him and fend for themselves” [4].

And listen, without comment, to that writer of the last war quoted by Wavell :—

“A man does not flee because he is fighting in an unrighteous cause, he does not attack because his cause is just ; he flees because he is the weaker, he conquers because he is the stronger—or because his leader has made him feel the stronger.”

When you get back to your units and start talking of this sort of thing you will rouse those who will tell you bluntly that you’ve forgotten that there is a war on; that while we have still so much training to do there is no time for these high-falutin’ ideas—and, anyway, that this is 1941 not 1914. This war is different.

Honestly, I am tired of hearing that last phrase. Because so few of those who use it really understand why and in what respect this is different from, I think, all other wars in which we have been engaged. We, and other peoples, have been up against world-conquerors, and would-be-world-conquerors, before ; and each of them has “invented” some “new weapon” which, when we look at it, is but some new method of employing, arming or moving the old weapons—men. Alexander, with the Macedonian phalanx : Cæsar, with his legions : Genghis Khan and Tamerlane, with their use of amazingly mobile speed and mass terrorization—this “Panzer” game has been played before : Napoleon—there’s nothing really new about it all : we can see the principles of Field Service Regulations clearly carried out down the ages by the successful ones. And this island has been invaded before, time and again ; and has survived, even gained, from those ordeals. But what is different, in our experience, I suggest, at any rate, is that we are now facing an opponent whose intention is, and he has expressed it plainly, the obliteration of the British race—no less. Total obliteration, save for such few of our womenfolk as display sufficiently marked Nordic characteristics to be worthy to be used as brood mares for certain of his lower classes: for the remainder—men, women and children—slaughter, or sterilization and the slave labour camp. That is what we are up against and that is where this war is different, for us, from all others that have gone before. What is going to defeat that ? Machines ? Machines don’t move themselves, or fight of themselves.

“The man is the first weapon of battle ; let us then study the soldier in battle, for it is he who brings reality to it. Only study of the past can give us a sense of reality, and show us how the soldier will fight in the future” [5].

The common private soldier . . .

Some people will tell you that this is not Hygiene, which I am supposed to be teaching you, but some other and quite different thing, not my job at all. I would then remind them that

“Hygiene is the study of man rather than matters. The study of the development of the soldier is more important than the study of the disposal of his fæces” [6].

To us in the Medical Service of the Army, the sound man, not the sick, is the important one because, little though many realize it or give evidence of so doing at times, an army exists to go to war and not to go to hospital. The “prevention of disease” is, undeniably, the larger part of our business and duties ; but we must go further than that on towards the “maintenance and promotion of health.”

We can go on, too, to better things than war ; we can take with us, out of this terrible break in our lives, as some few did from the last disturbance, something for the days to come—man-management—the art of getting the best out of those placed and working under us by doing the best we can for them ; not only in the large matters of sanitation and environment, housing, feeding, clothing, work and play ; but also, and often especially, in the small matters that become so largely important in the production of peace and happiness. “ Freedom from fear is the beginning of wisdom ” [4]. Make no mistake about it, this will be a hard battle if we undertake it.

“ The forces of reaction, which fought Disraeli in 1875, will rally to curtail health activities in the future for exactly the same reason—that the country cannot afford it. Those who believe, on the other hand, that the country cannot afford disease and death will require to arm themselves with exact knowledge of all the manifold conditions of healthy living in order to defeat the campaign which will be launched after the war to diminish the activities of the public health services ” [7].

Can't you take our hygiene of the field and the barrack room, which we have been trying to teach you, on even into the higher spheres of civil life, and realize that our “ chain of infection ”—“ source-route-destination ”—can be applied equally to the social, mental and, if you like the word, psychological difficulties of our fellowmen ? We are not just wasting our time here ; we can be learning the highest arts of peace through the trials of war.

When we have become really conscious that no man can suffer alone—that every man's sufferings and privations are part of the body politic—that they react on, and remain as sources of infection of, the remainder of his fellows ; and when we have persuaded ourselves, by simple trial, how essentially easy it is, first to interrupt the passage of an infection, then to aid the recovery of the sufferer and to protect the still healthy if only we will all work together, isn't there something very much better than anything past which we can put, and keep, in our view as the brave new world which we will rebuild ?

Bring me my Bow of burning gold :
Bring me my Arrows of desire :
Bring me my Spears : O, clouds unfold
Bring me my Chariot of fire.

I will not cease from Mental Fight,
Nor shall my Sword sleep in my hand
Till we have built Jerusalem
In England's green and pleasant land.

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I am indebted to Colonel E. B. Allnutt, M.C., Commandant, Army School of Hygiene, for forwarding this lecture for publication.

EXPERIENCES OF WAR SURGERY IN FRANCE AND ERITREA.

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It is difficult to know when one's own experiences are of interest to other people but Colonel McAlpine has almost ordered me to offer my experiences of war surgery to the R.A.M.C. Journal and I think that if I relate certain episodes in France and Eritrea, it will prove to readers of the Journal the least tedious method of complying with the Colonel's wishes.

In March, 1940, I was sent to Metz to serve as surgeon to the C.C.S. which was receiving casualties from British units in front of the Maginot line. At that time this was the only place where there was active fighting and from March to early May the C.C.S. received a constant small stream of men wounded in patrol fights and by odd bombs and shells. This stream was small enough to allow time for a thoughtful examination of the wounded, for unhurried operating and for retaining the patients in the C.C.S. for from ten to fourteen days.

The Metz unit was rather a hybrid, resembling most closely the light section of a C.C.S. Our official title was "C.C.S., W-Force," and we finally consisted of five officers, six sisters and forty-three other ranks. We were housed in a wing of a French military hospital which was already completely equipped and, Metz being only twenty miles behind the front line, the wounded took from four to twelve hours to reach us. The conditions for securing primary suture of wounds were ideal and we carried out this procedure, after careful excision, in about twenty-five cases. Two became so infected that all stitches had to be removed and one or two others needed the removal of one stitch but, on the whole, we were pleased with the results.

Life at Metz was very pleasant. The town and surrounding country, which we explored on bicycles, were lovely in the spring weather. The Moselle river and its wines were a delight, our mess had the services of a widow woman who cooked exquisite meals and we saw interesting aspects of the fighting at a safe distance. But this halcyon existence was rudely shattered when the Germans made an expensive and unsuccessful attack in the Metz sector on May 12 and 13. The C.C.S. was almost overwhelmed with work for in three days we took in ninety wounded and did fifty operations. No sooner was the operation list nearly finished than more ambulances would arrive. I found that sixteen hours operating on end was as much as I could do when starting fresh and I averaged rather more than one operation an hour. It was fortunate that the rush of admissions lasted only three days since after two sixteen hour sessions with a ten hour rest between I felt dead beat for two days. Our resources were strained in other ways also for the French turned off the gas during air raids so often that we could only do wet sterilizing and we finished up by operating in a macintosh apron and a pair

of gloves which were merely scrubbed between cases. Sterile towels were economized by using a single towel with a hole cut in the centre in place of four.

We had foreseen some such rush as took place and had planned for it as far as our accommodation would allow. Our method of working was to admit cases at once to the ward. They were then seen as soon as possible to decide on the necessity or otherwise of operation and brief notes were made, especially of the time of injury, of the type of missile and, in limb injuries, of the integrity of the peripheral nerves. All these are points which cannot be checked after the anæsthetic has started. The operation cases were given morphia and atropine and were then screened in the X-ray room if treatment was not urgent. The screening was often done by a general duties officer and, where foreign bodies were found, our method was to mark the skin in ordinary ink making an A over the F.B. in the antero-posterior position and an L in the lateral position. These marks were preserved by scratching them with a needle before preparing the skin. This method proved quicker and more reliable than taking plates, as we did not require the finer details of fractures. The screening completed, the cases were lined up outside the theatre in their order of urgency and we worked through them.

Just before the beginning of the rush I decided that a local packing of the wounds with sulphanilamide powder, of which I had read, might be of benefit to our cases. The results astonished us by their excellence and twenty or thirty cases were done thus. This treatment was then in its early stages but what is now a commonplace came to us as a revelation at that time for the wounds were worse and, perforce, more hurriedly dealt with than anything we had previously seen. Unfortunately the stress of the times deprived us of a properly controlled investigation of results.

Our anæsthesia, particularly with continuous pentothal, was a constant source of wonder to our French colleagues who relied on orderlies to render their patients unconscious. The apparatus with which the orderlies effected this was a primitive Clover inhaler capable, it seemed, of producing deep anæsthesia only after the operation had been in progress for some time.

Before I take leave of Metz, I would like to relate two professional anecdotes, one grave, the other gay. The first concerns a man wounded in the chest by shrapnel. He was admitted eight hours after being hit and was seen to have an open pneumothorax. X-ray showed a piece of metal deep in the chest. I operated, intending to close the chest only, but as I was preparing to do this a piece of omentum prolapsed. I opened the chest widely and found a tangential wound of the diaphragm through which the omentum was escaping. After reducing the latter, I repaired the diaphragm and put into the chest a Curv-lite retractor. A small black mass was seen on the pericardium and, in trying to pick this off, I drew out of the heart a piece of metal about an inch long after which I closed the chest. The man died suddenly six days later after doing well. A post-mortem showed advanced pericarditis but his pleura was in good shape. I wished afterwards that I had excised a piece of the pericardium and put in sulphanilamide powder. The other story is about blood transfusion, a measure we used very little and for which we were compelled, with our small staff, to rely on the French.

We had a very exsanguinated patient whose leg I had just amputated for a severe fracture involving the popliteal artery. We therefore called in our French colleagues who arrived with a donor and a very neat little pumping machine for giving direct transfusions. Recipient and donor veins were duly connected up and an excitable French M.O. began turning the handle of the pump, explaining meanwhile how simple it all was. This simplicity soon became obvious, for the patient received 250 c.c. of blood in one minute. He then sat up, having so far been comatose, and called the Almighty and his mother to witness that he could not breathe. We sensed that the right heart might be somewhat overloaded and we pointed to a dial on the pump for counting the revolutions of the handle and asked the Frenchman to explain its purpose. He ceased to twirl the handle and explained, the patient sinking back into coma. We then felt the pulse and expressed ourselves as well satisfied with the results of the transfusion. The machine was disconnected and, to cut a long story short, our patient was married two months later in England.

Towards the end of May it became clear that the Maginot line was being out-flanked. Our troops were withdrawn to the Somme and we were recalled to Le Mans. A day or two afterwards I was posted to Rouen. I arrived there on the evening of June 5, 1940, and was operating an hour later. The General Hospital to which I was attached had just opened and was being inundated with about twelve hundred casualties a day. The four surgical teams available worked continuously in eight-hour shifts, two on, two off, during the whole time I was in Rouen. We knew that only a fraction of those needing operation could receive attention and we had to leave the really bad wounds, as being too time consuming, in order to give the greatest number of men the best chance. Our eight hours off duty seemed all too short since sleep was curtailed by the need for meals and by having to leave our tents during the heavier air raids. This five-day nightmare was ended by the arrival of the Germans on the further side of the Seine, and the Hospital had to pack what it could and go. I had the doubtful honour of being a member of the rear party and was suturing a stomach when the Seine bridges were blown up. I closed the abdomen wearing an unboiled tin hat and our patient, heavily morphinized, was loaded on to an ambulance when two hours later at dawn the rear party left.

Our drive back was dramatic and rather terrible. We reached a Base Hospital on the west coast of France near St. Nazaire but orders to evacuate this soon arrived. We departed in an ambulance train commanded by a Middlesex man, Eric Sibley, our enjoyment of the journey being marred by the fact that nobody knew whether the line had been cut by German tanks, and our driver kept stopping to confer with signalmen. We finally reached the Brittany village of Quiberon and it was with relief that we saw a hospital ship steam into the bay to embark the wounded and ourselves for England.

It is a far cry from France to Eritrea but I will skip the steps intervening up to the moment when in January, 1941, I left Cairo station as surgeon to a mobile team bound for Kassala. The first part of the journey was interesting and comfortable but its latter end reached a climax of dawdling discomfort of which my chief memories are dust, sweat and flies.

The team was composed of an anaesthetist, myself and two theatre orderlies, together with operating equipment. We found the 2nd Indian C.C.S., to which we were ordered to report, encamped beside the railway round a nucleus of two bungalows and we were given the British section, dealing with officers and European troops, to look after. The nursing personnel for our section was provided by the arrival of a staging section commanded by a Middlesex man, Captain John Gordon. The front line was some two hundred miles in advance by the time we reached Kassala and the troops were about to make their first attack on Cheren. The wounded were evacuated to us by motor ambulance or lorry over appalling roads and the wounds we had to treat were often days old. Moreover we had to evacuate every case without delay to the base hospitals by ambulance train. Here we had a very different problem from that at Metz, for the surgery necessary to make a wounded man as safe and as comfortable as possible for travelling at the earliest possible moment differs from the treatment which one would carry out at the Base. In brief it consists of doing the minimum of operating compatible with good drainage and good fixation. We had no X-ray plant available but this was, surprisingly enough, no great disadvantage for the type of surgery we were called on to do. One often felt a foreign body as soon as one introduced a gloved finger into a wound which clearly needed further incision.

Kassala is the most fantastically frightful spot. There is a special variety of dust storm distinguished by the extreme fineness of the dust. The town, a grubby affair with one decent shop which carries on business under the picturesque title of The Abyssinian Trading Co., is about a mile from the railway. The inhabitants however are quite intriguing and among a motley one could pick out Eritreans, who are black skinny people with high cheek bones and thin lips, and Fuzzy-Wuzzies who are big men with a great shock of curly hair. They have an amusing way of carrying their iron rations when off in the bush: they smear their hair with mutton fat, rub in flour and suck their locks if they get hungry, a custom which does not add to their personal freshness. They struck us as being the real darkest Africa touch, with their spears, their ornaments stuck through their noses and their tattooing. The surrounding country is flat dry scrub to the east and to the west the Eritrean hills start with a huge granite boulder, a thousand feet high and bare as an egg, which looks as though it had been carelessly dropped by some giant. We experienced heat up to 110° most afternoons and were plagued by a variety of enormous and terrifying insects. There was no electricity and no fans but we were blessed with a piped water supply from the station tanks. The remains of the Italian rout were everywhere visible in primitive earthworks, observation posts and empty Chianti bottles. Kassala was the only place of importance captured by the Italians and their front line was never far from it. We were told that the native schoolmaster of Kassala, an employee of the Crown, used to pass through the Italian lines every Saturday morning, make for the nearest representative of the Sudan government, draw his weekly salary and return home.

The first attack on Cheren failed and, while our troops were being rested and reinforced, the C.C.S. had a quiet time. A railway was meanwhile being built

into Eritrea to a place called Tessenei, a few miles inside the Sudan-Eritrean border. This work was finished about seven weeks after our arrival in Kassala and, when railhead was shifted to Tessenei, we were glad to be shifted with it for Kassala was dreadful when one had plenty of time to think about it. At Tessenei we were attached to No. 11 Indian General Hospital. The hospital was mostly tented but had a small Italian civil hospital for the worst cases. The team again took over the surgery for casualties among English personnel. The surrounding country was a slight improvement on Kassala in that there was thicker scrub and more hills, but the place was an oven. Its speciality was "dust devils," whirling columns of dust perhaps a hundred feet high and twenty feet in diameter which moved across the plain like a water-spout at sea. A specimen passed through our tent one day while Major Grierson, our anæsthetist, was lying in bed. He was nearly choked and it was difficult to distinguish his features from the surrounding pillow, so covered in dust were both.

We arrived in Tessenei during the second and successful attack on Cheren and we worked hard for the first few days. It was surprising how slight most of the wounds were. Perhaps the majority were caused by the tiny Italian hand-grenade of which one man could carry a couple of dozen in his pockets: these missiles burst into a shower of aluminium fragments which spattered the skin but failed to penetrate deeply. They caused peppered wounds, painful and disabling at the time but often completely healed two days after the scab had separated. To the underside of the scab the metal fragment was usually adherent.

Various incidents kept us amused at Tessenei. One day the Indian orderlies' rations, which consisted of two live goats, were eaten by a wild beast reported to be a lion. Lions had not been seen in the neighbourhood for fourteen years but our big game shots procured further goats the next night and ensconced themselves nearby in lorries. When the goats were heard to utter cries, the headlamps of the lorries were switched on and a small hyena, terrified by a fusillade of rifle fire, fled unscathed into the night. On another occasion our tent was invaded one night by a gigantic spider which Grierson, an agile man, trapped under a six inch enamel bowl. It was too big to fit under this and its two hind legs were amputated by the bowl's rim at mid-thigh. Grierson, true to his calling, finished it with a Flit gun and the autopsy showed a body two inches long and about five pairs of legs, each five inches long when stretched out. We tucked our mosquito nets round us with particular care that night though these spiders, far from hurting men, attack and eat scorpions; they get an ample diet in Tessenei. Yet another bizarre experience occurred after a small explosion at the station in which some local Eritrean labourers were seriously wounded. One of them, who had a piece of metal in his liver, subsequently died. I wished to do a post-mortem but, on arriving at the mortuary tent, I found that the family was laying out the body. They stood aside however and clearly expected me to continue with whatever I had come to do. In the presence of this interested audience I did a limited post-mortem and recovered, amid murmurs of approbation, a piece of metal from the centre of the right lobe of the liver; my orderly had thoughtfully told me that I must work with a scalpel while he unobtrusively held on to the

larger knife we had brought in order to protect my back if I unwittingly committed a sacrilege. The family were a coal black, wild-looking lot. However, I handed the fatal missile to the senior member present and he received it with indications of gratitude for my assistance. I then sewed up, using what I hoped was an impressive surgical technique, and was ushered from the tent with every sign of goodwill. I hope this is the last time that I perform an autopsy with the relatives in attendance.

By the middle of April our troops were well into Abyssinia and the hospital at Tessenei was so slack that Grierson and I had a few days' leave. We arranged with some officers in the Cape Corps motor transport to board one of their lorries bound for Cheren and Asmara. The first day's journey was to Agordat over very rough roads. Next day the going improved as we neared Cheren and, when we finally wound up the Cheren gorge which our troops had so recently taken, we were astonished at their feat. The road from Cheren to Asmara ascends in mountainous country and one could not help feeling that a stubborn Italian resistance and a little more scorched earth policy in the shape of road demolition must have held up our troops almost indefinitely. As it was, only three road blocks were encountered which the magnificent work of the Indian sappers had soon cleared. Asmara itself is a pleasant town nearly 8,000 feet above sea-level and the contrast in temperature with the plains was delightful. The town had had one stick of bombs dropped across it and the damage was negligible but the aerodrome was a sight to rejoice any British heart, littered as it was with burnt-out Italian planes and the remains of fire-blackened hangars. We did the return journey of about 250 miles to Tessenei in a Cape Corps staff car and we again paused at the Cheren gorge to inspect Fort Dologorodoc. So powdered were its defences by gunfire that it was difficult in places to make out the ramparts. One had a wonderful view of Mount Semchal on the opposite side of the gorge and of the plain at our feet, along which our troops had had to advance. The road, and its approaches for miles, were completely commanded by these two positions in both of which the Italians were strongly entrenched. The storming of the Fort will, I imagine, rank as an epic in the history of war. The deed filled us with wonder as we stood on the site of its achievement.

We were not long to endure the heat and dust of Tessenei after our return from Asmara. Orders came for our return to Cairo and we retraced our steps via Khartoum (temperature 116° under the hotel fans) and the Nile.

I feel that this slice of reminiscences is somewhat unsuitable to my age but I hope that my attempt to put across the "old campaigner" stuff will cause amusement in one way or another.

VITAMINS.

BY LIEUTENANT-COLONEL C. S. RYLES, *O.B.E.*,*Royal Army Medical Corps.*

OUR knowledge about vitamins is fluid. It ebbs and flows, swirls and eddies, making the observer giddy.

General.—We know that, when vitamins are deficient in a diet, the body is laid open to attack by disease; greater lack or absence produces one or other of the deficiency diseases. Sometimes, possibly, their want enables toxic substances in certain plants when ingested to act banefully upon the human tissues, e.g. lathyrism. But, speaking broadly, the mode of action of vitamins is still obscure.

Patients on a restricted diet may not receive the vitamins necessary. These, even when ingested, may yet fail to reach the tissues where they are required. Disease or malformation of the gut may cause faulty digestion or faulty absorption. The fat-soluble vitamins require, for their absorption, the presence of bile in the intestine.

Avitaminosis may lie hidden to appear only after a period of strain, e.g. at puberty, during pregnancy or lactation, after operations, fracture or serious illness.

Balance is vitally necessary in many aspects of dietetics but, in none more than in this question of vitamin supply (with which we must associate the necessary supply of salts).

Complete starvation will produce a picture differing widely from that produced by vitamin deficiency.

Amounts of vitamins may be measured in milligrammes or in International Units. See Appendix.

Fat-soluble vitamins: A, D, E and K.

Water-soluble vitamins: B and C.

Other vitamins are not discussed here.

The conservation of vitamins and salts in cooking is of great importance. A Report by the Medical Research Council should be consulted on this subject.

VITAMIN A (LINKED WITH D AND E).

Sources.—Green vegetables—in the green outer leaves, not in the white inner leaves; in many fruits, cereals, and some root vegetables, especially *carrots*; but, the human body cannot make use of the vitamin A in raw carrots. Chopped and grated vegetables quickly lose their vitamin A. Vegetable oils contain none, except red palm oil. Margarine, from whatever source, must be "fortified," i.e. vitamin A must be added.

Fish-liver oils contain much; also, all animal fats and egg-yolk. Pasture-fed

cows yield milk rich in vitamin A ; not stall-fed cows. Butter and cheese will contain as much as the milk from which they were made. Mothers should be supplied liberally with A-containing foods while nursing infants. Lard from pigs fed on swill contains no vitamin,

Biochemistry.—Vitamin A occurs as such in animal tissues ; in vegetables, as pro-vitamin A, or “ carotin,” which in the liver is converted into vitamin A.

Vitamin A is an alcohol ; carotin, a hydrocarbon. Tablets of either can be obtained. Vitamin A has been synthesized.

Daily requirements :	Vitamin A.	Carotin.
Minimum for adults	0.9 mgm.	1.8 mgm.
Optimum for adults	1.2 to 1.8 mgm.	2.4 to 3.6 mgm.

It is a fat-soluble vitamin.

Stability, and storage in the body : Stable at high temperatures but in the presence of oxygen readily oxidized and thus destroyed. Ordinary cooking and canning processes are unlikely to cause significant loss. Excessive radiation destroys.

Stored by the adult body in quantity enough for several months ; by children, less ; almost none by infants.

Functions.—Adequate vitamin A is essential for growth and development in the young and for resistance against infection at all ages. It has a specific relation to epithelia throughout the body—skin, mucous membrane, especially of the respiratory and alimentary tracts and the lining of the renal tubules. When vitamin A is deficient the cilia in the air-tracts slough off, the intestinal villi atrophy and thus the tissues are left open to bacterial invasion.

Deprivation causes keratinization of epithelial structures—“ toad-skin,” xerophthalmia (keratomalacia), renal calculus, dental caries. Because of the structural changes, administration of vitamin A will cure but slowly. Night-blindness is a result of deprivation but there are other causes, e.g. retinitis pigmentosa, hysteria, deficiency of vitamin B. In lathyrism, a condition of spastic paraplegia occurring in those who eat the pea, *Lathyrus sativus*, it is thought that lack of vitamin A permits the neurotoxin in the pea to become active.

It is claimed that large doses of vitamin A improve hyperthyroidism.

VITAMIN D (CALCIFEROL).

Antirachitic. Is linked to vitamin A. When deficiency of one is feared, both should be administered.

Sources.—Body and liver oils of fish ; egg yolk ; butter, especially from pasture fed cows ; milk contains little but this becomes concentrated in the butter.

Biochemistry.—Vitamin D may occur as such (calciferol) or as Pro-vitamin D (ergosterol) which requires exposure to sunlight or other source of ultra-violet rays to convert it into vitamin D. This irradiation may occur while the ergosterol is circulating in the body capillaries immediately below the skin surface.

It is an alcohol and fat-soluble.

Daily requirements :

Optimum for children and adults 0.0075 to 0.01 mgm.

„ „ lactating women 0.02 mgm.

Stability and Storage : More stable than vitamin A but stored to a lesser extent. Cooking and canning have but little adverse effect.

Functions.—To promote absorption of calcium and phosphorus from the intestine, regulate their metabolism and fix calcium in the bones and teeth. Has important relation to the bone-marrow.

Deprivation is the cause of rickets. (Tetany, a sequel of rickets, is here a complication of the fundamental disease process.) To prevent rickets, a child must have either (a) food containing vitamin D, or (b) sunlight or other source of ultra-violet rays or both ; and, in addition, (c) food containing calcium and phosphorus in correct proportions. Rickets develops more readily when the diet contains a large proportion of cereals.

In the later months of pregnancy and during lactation the mother should have ample vitamin D and calcium.

Adults, when vitamin D is deficient, may develop osteoporosis, osteomalacia, and similar conditions, especially during or after a period of strain, e.g. puberty or pregnancy.

Overdosing with vitamin D may produce premature and excessive calcification.

VITAMIN E.

Anti-sterility factor acting through the anterior lobe of the pituitary gland.

Sources.—Especially wheat-germ oil ; also in green tissues of vegetables. Small quantities in animal fats and oils, in milk, butter and vegetable oils. None in fish oils.

Biochemistry.—The unsaponifiable part of fats and oils consists of sterols, of which tocopherol is one. Tocopherol is identical with vitamin E. It is fat-soluble.

Stability and Storage.—Extremely stable. Storage unknown.

Functions.—In laboratory animals, deficiency of vitamin E produces two effects. (a) Sterility. In female animals, conception occurs normally but death and subsequent resorption of the foetus occurs ; and, with prolonged deprivation, lesions of the uterus and ovaries develop. In male animals, there is an irreversible atrophy of the germinal epithelium. (b) Muscular dystrophy. In prolonged depletion, degenerative changes occur in the muscle fibres.

In man it has not yet been established that any harm accrues from deprivation. In habitual abortion of women, several workers have claimed successful results with vitamin E therapy. Also, using large doses, it is valuable in the treatment of amyotrophic lateral sclerosis and muscular dystrophies.

VITAMIN K.

Anti-hæmorrhagic factor.

Sources.—Spinach and other green vegetables. Alfalfa grass.

Biochemistry.—Natural vitamin K is found in the non-sterol fraction of the non-saponifiable part of the lipoids from the sources mentioned. Its chemical composition is—2 methyl, 3 phytyl, 1, 4 naphthoquinone. The active portion of the molecule is—2 methyl, 1, 4 naphthoquinone, which can be synthesised and given orally or parenterally. Vitamin K is fat-soluble.

Functions.—It appears to play an essential though little understood part in the formation of prothrombin and is therefore concerned in blood-clotting.

Deficiency causes a fall in the blood-prothrombin level, a prolonged clotting time and a hæmorrhagic tendency. In man, two conditions are definitely known to be due to vitamin K deficiency—the hæmorrhagic tendency in severe liver disease and neo-natal hæmorrhage; both respond to vitamin K therapy.

Little is known of its metabolism or storage. For its absorption the presence of bile is necessary in the intestine.

Relation to viperine poisons now used to promote blood-clotting in hæmophilics?

VITAMIN B.

Truly, a complex.

B₁—antineuritic beriberi-preventive factor.

B₂—a complex in itself. (a) Riboflavin—angular stomatitis (cheilosis). (b) Nicotinic Acid or P.P. factor—glossitis. (a) and (b) together prevent pellagra/sprue.

B₃₋₆—Preventive factors in rats and other laboratory animals; do not concern man.

VITAMIN B₁.

(British, Aneurin; U.S.A., Thiamin or vitamin F.)

Sources.—Germ, or embryo, of wheat, rice, barley, rye; in the pericarp of grain and the aleurone layer of rice. Eggs and tomatoes and yeast (Marmite) which also contains B₂.

Though it occurs in many foods, it is not greatly concentrated in any animal or plant tissue.

Biochemistry.—A crystalline substance consisting chemically of a pyrimidine ring and a thiazole ring. Obtainable in synthetic form.

Daily requirements—minimum, 1 mgm.; optimum, 2 mgm.

The amount excreted in the urine can be taken as an index of the nutritional level.

It is water-soluble.

Stability and Storage.—Vitamin B₁ is destroyed by heat (B₂ is not). Less affected by oxidation than other vitamins. When in an acid medium it is more resistant to heat. No great loss occurs in cooking unless soda is used; but much vitamin is thrown away with the water used in cooking. Considerable loss in canning. Bread, in baking, will lose what vitamin B₁ the flour contains if baking-soda is used; not if “raised” with yeast.

The period of development of beriberi in man has been determined at eighty to ninety days.

Functions.—Vitamin B₁ plays a part in one phase of carbohydrate metabolism. It is concerned in breaking down pyruvic acid which is a product intermediate between glucose and CO₂. Deficiency causes increase of pyruvic acid in the blood ; this can be measured.

Evidence is now convincing that, in modern diets, vitamin B₁ is deficient. Obviously nature intended us to obtain most of our vitamin B₁ from cereals but man insists upon *white* bread or rice and, to obtain it, removes from the grain, by milling or polishing, the B₁-containing portion. Bakers foster the taste for white bread because such flour keeps well and is easy to bake into a handsome loaf ; but the vitamin is lost. Peasants in many countries, subsisting on the staple diet of rice or maize, cannot afford to buy other B₁-containing foods ; thus, since the rice is polished, beriberi occurs.

Indian troops prefer their own coarsely ground wheat flour, "atta," from which they make unleavened bread. In the Siege of Kut (1916), British troops suffered from beriberi but Indian troops, on atta, escaped. Marmite, $\frac{1}{4}$ oz. three times a week, will be issued from R.A.S.C. Stores on G.O.C.'s order when considered necessary. It should be noted that Marmite does not keep very well. Yeast may be obtained from R.A.S.C. bakeries.

Deficiency or absence of vitamin B₁ leads to malnutrition of the nervous system, disorders of digestion (vicious circle), dysfunction of endocrine glands and lowers resistance to infection. Early features of deficiency are—loss of appetite and weight followed by decreased sugar tolerance, nervous symptoms, faulty vision, bradycardia and œdema. Beriberi finally develops. The neuritis of chronic alcoholics and of pregnancy (usually with pernicious vomiting) are due to lack of vitamin B₁, which may also possibly be concerned in producing leprosy.

Children and expectant mothers should be given ample vitamin B₁. It is certain that no harm accrues from excess.

Given a restricted food choice any lowering of the body resistance may lead to the sudden development of beriberi, e.g. pregnancy, lactation, post-operative state, convalescence after enteric, dysentery, etc. Breast-fed babies of mothers suffering from beriberi are themselves liable to suffer from the disease.

VITAMIN B₂.

Pellagra/Sprue preventive factor.

Maintains the health of the skin, mucous membranes, and nervous system. Prevents anæmia. The more *fat* ingested, the greater need for vitamin B₂.

(a) *Riboflavin*.

Sources.—Especially yeast, liver, eggs, milk. Cereals have but little.

Biochemistry.—Riboflavin is a yellow fluorescent pigment seen in the greenish-yellow colour of whey.

Its chemical structure is complicated. It is readily synthesized in the laboratory but not in the animal body ; it must be ingested as riboflavin.

Daily requirements 1·2 to 3 mgm.

Stability.—It is heat stable as compared with vitamin B₁. Storage unknown.

Functions.—Riboflavin, combined with phosphoric acid and a protein, forms "Warburg's yellow ferment" which is concerned in the normal oxidizing system of cells (cellular respiration).

Deprivation causes, in man, angular stomatitis, seborrhœic accumulations on the face, and ocular changes, e.g. photophobia, keratitis, cataract, pellagra/sprue.

(b) *Nicotinic Acid* and Nicotinamide.

(The P.P. factor. U.S.A., vitamin G.)

Sources as for Riboflavin.

Biochemistry.—Nicotinic acid is a simple carboxylic acid of pyridine which is prepared by the oxidation of nicotine. It occurs as white crystals, resistant to heat and oxidation. Formulae— $C_5H_4N\ COOH$ and $C_5H_4N\ CONH_2$.

It is a co-enzyme, and plays a part in carbohydrate breakdown, but its exact function is as yet unknown.

Amounts of nicotinic acid in the urine can be estimated.

Daily requirements. Figures given vary between 5 and 25 mgm. Below 4 mgm., pellagra will appear.

Deprivation causes glossitis in man, "black-tongue" in dogs.

Pellagra, Sprue and Pernicious Anæmia.—Manson-Bahr, in an able paper, links up these conditions, showing that all three are due to defects in the alimentary canal with "intestinal hurry." The site of the defect varies with the disease. There may or may not be vitamin B₂ deficiency in the diet but, owing to his defect, the patient is not receiving what amount is available (vicious circle).

He directs attention to the effects of surgical interference with various parts of the gut, these effects being similar to those of pellagra, sprue or pernicious anæmia. The following table sets out his views:

I.—Pernicious Anæmia Syndrome. (Gastroduodenal inefficiency.)

(1) Primary Pernicious Anæmia—naturally occurring disease (absence of intrinsic factor).

(2) Secondary Pernicious Anæmia—artificially produced disease after partial gastrectomy.

II.—Sprue Syndrome. (Jejuno-ileal inefficiency.)

(1) Primary Sprue—naturally occurring disease.

(2) Secondary Sprue—after gastrojejuno-colic fistula, gastro-jejunostomy and short circuit, neoplasm of small intestine, mesenteric tuberculosis, lymphadenoma.

(3) Coeliac Disease—congenital absorption defect in small intestine proceeding to idiopathic steatorrhœa in adults.

III.—Pellagra Syndrome. (Ileocæcal inefficiency.)

(1) Primary Pellagra—naturally occurring disease, absence of vitamin B₂ complex.

(2) Secondary Pellagra—after damage to ileum, etc., by chronic dysentery, alcohol, and surgical interference.

Further, Manson-Bahr finds that daily administration of 300 mgm. of nicotinic acid and 3 mgm. of riboflavin will cure sprue as well as pellagra.

VITAMIN C. Ascorbic Acid.

Antiscorbutic.

Sources.—All *fresh* animal and vegetable foods, especially oranges, lemons (not limes), tomatoes, green vegetables. Vegetables have a higher vitamin C content than fruits usually found on the table. Rose-hips and black-currants are rich.

Germinated pulses. See Army Manual of Hyg. and San.

Stability.—Destroyed in cooking unless care is taken. Canning destroys the vitamin except tomatoes. Jam should be fortified.

Foodstuffs dried by the Low Temperature Process retain their vitamin C content well. This process, after the War, may largely replace canning.

Storage.—Sixty days' supply. (Some consider that the body stores as much as 167 days' supply.—Ed.)

Biochemistry.—Ascorbic Acid— $C_6H_8O_6$ —a potent reducing agent, is feebly acid and related to sugars. Synthetically produced by chemists and cows. The tablets are a R.A.S.C. supply.

Daily requirements—30 mgm., optimum, 50 mgm. No other subject in all hygiene is so liable to produce "bees in bonnets" as "deficiency of vitamin C." Scars occur periodically on behalf of the Army; none have had any justification so far.

Functions.—Vitamin C has a specific relation to the supporting tissues of the body, "enabling the cells to produce and to conserve intercellular substances that cause setting of the matrix wherein the cells lie and are supported"; particularly of blood capillaries whose settings may become loosened for want of vitamin C, and thus blood exudes between the capillaries into the tissues.

There is evidence that vitamin C is not the whole story: a second vitamin—P, or "citrin"—occurring richly in orange peel and juice and also found in black-currants seems to be necessary.

Deficiency leads to hæmorrhages in various parts of the body, swelling of the joints, trouble with the teeth, changes in the bone-marrow, fragility of the bones. Wounds refuse to heal properly. Scurvy may occur. Many affections of the teeth and gums, however, are quite unconnected with vitamin deficiency, e.g. pyorrhœa.

Vitamin C shares with vitamin B a specific relation to the adrenal glands, its chief storehouse in the body. The adrenals enlarge when vitamin C is deficient. It has relation also to the anterior lobe of the pituitary.

Ascorbic acid ingested in excess of the body's requirements spills over into the urine. To determine the vitamin C content of a man, a definite quantity of ascorbic acid is given and the urine spill-over subsequently measured.

APPENDIX.

DAILY VITAMIN REQUIREMENTS.

(From summaries in a series of articles in the *Journal of American Medical Association*, 1938, and also from "The Avitaminoses," by Eddy, and Dalldorf, London, 1941.)

<i>Vitamin A</i> .—One International Unit—0.0006 mgm. carotene.				
" " " approximately 0.0003 mgm. vitamin A.				
		<i>International Units</i>	<i>Vitamin A</i>	<i>Carotene</i>
Minimum for adult	..	3,000	0.9 mgm.	1.8 mgm.
Optimum " "	..	4,000 to 6,000	1.2 to 1.8 mgm.	2.4 to 3.6 mgm.
<i>Vitamin D</i> .—One International Unit—0.000025 mgm. calciferol.				
		<i>International Units</i>	<i>Calciferol</i>	
Optimum for children and adolescents	.. .. .	300 to 400 (1,500)	0.0075 to 0.01 mgm.	
Optimum for adults	.. .. .	300 to 400	0.0075 to 0.01 mgm.	
" " lactating women	.. .. .	800 (1,500)	0.02 mgm.	
<i>Vitamin B₁</i>				
		<i>International Units</i>	<i>Aneurin</i>	
Minimum for adult	.. .. .	333	1 mgm.	
Optimum " "	.. .. .	666	2 mgm.	

Editorial.

TRUETA'S MESSAGE.

GREAT men always manage to express great truths in the shortest possible space. Foch put the whole of his theory of strategy and tactics in a sentence: "The parrot, a cunning creature, holds on in the centre with its beak and climbs by advancing its claws." What could be more concise, simple and effective than that? And was it not John Hunter who replied to the cogitations of a colleague, "Don't think! Try." Something of the same brevity and wit is evident in Trueta's manner of dealing, in five sentences, with the short treatment of war wounds and fractures, as detailed in the *Brit. Med. Journ.* for May 16, 1942. They are expressed as follows: "(1) Prompt surgical treatment; (2) cleansing of the wound; (3) excision of the wound; (4) provision of drainage; (5) immobilization in a plaster-of-Paris cast."

Point 1 contains a lesson for every regimental stretcher bearer, every orderly, whether working in war between a First Aid Post and Advanced Dressing Station or in the sudden emergency of an Air Raid; every Medical Officer called to give the first surgical attention to and arrange for the evacuation of a wounded man. For all these, a sentence to be emblazoned on the heart is Trueta's adjuration: "The shorter the period during which the casualty is left untended, the shorter the time taken in transport to hospital, the earlier can resuscitation begin and the patient be ready for operation." We should like to say to all of them, stretcher bearers, orderlies and regimental medical officers: "Be thorough but, above all, be quick. Remember that the life of the man is at stake. Get him to where his shock can be dealt with and his wound attended. *Hurry up!*"

Point 2.—"No antiseptic known to-day is equal to soap and water as a means of dealing with contamination in a wound." We have now reached the point where the wound can be dealt with, be it at a Field Dressing Station relatively close to the fighting or, through the wonders of our modern ambulances, at a Main Dressing or Casualty Clearing Station much further from the scene of active operations. "Soap and water!" Nothing more "high-brow" is necessary! True, it must be applied very thoroughly; the wounded man is probably very dirty and, as for the wound itself, all sorts of things can be carried in with the missile. We can remember, after our first battle, a simple-looking wound of the front of the thigh from which, however, was gradually recovered the punched-out remnant of a "Sudan Prayer Book!" The Chaplain had distributed his gifts just before the engagement and our patient had placed the little volume in his haversack! For the casualties from an air raid, covered as they are with dust, plaster and fragments of buildings, the need for thorough washing is still more obvious.

"For the skin a solution of iodine or a similar skin antiseptic should be used. At the end of the operation the wound may be dusted with sulphanilamide."

The latter had not been evolved when Trueta treated over a thousand cases with uniformly good results, a few exceptions only being noted, but still he recommends it as "there now appears to be enough experimental evidence to justify the local application of one of the sulphonamide compounds as a prophylactic measure." For us, dealing as we often must with cases which have lain out for some hours, either through their not being found at once or through the impossibility to carry them over an area exposed to heavy fire in daylight, this precaution is more especially necessary. The wounded arriving at General Hospitals in the Middle East, even four or five days after the receipt of their wounds, were found in an astonishingly good condition owing, probably, to sulphonamide having been used. This is a point which cannot be ignored in the case of a wounded man obliged through stress of circumstances to pass on rapidly from the Field Ambulance or Casualty Clearing Station with only a preliminary dressing.

Trueta gives special instructions for "Front-line Casualties" who have been lying out for some time or whose evacuation has taken several days.

As to *Points 3, 4 and 5*, these raise considerations for the surgical specialist. We must, however, quote certain sentences. "*Without proper excision no recent wound should be enclosed in plaster.*" "To ensure proper excision the wound must first be enlarged, the *débridement* of the French." "Good plaster-of-Paris is highly absorbent and the direct contact between the dry gauze and the plaster covering the wound facilitates the rapid absorption of the relatively small amount of discharge which comes from a clean wound."

This brief article, written by a man with great experience, may well prove to carry more weight than many of the complicated and difficult papers of those trying experiments with wounds.

Clinical and other Notes.

EXPERIMENTS IN HEATING IN THE DESERT.

BY CAPTAIN G. S. N. HUGHES,

Indian Medical Service.

GENERAL.

A SERIES of experiments has been carried out and is being continued in this hospital in the Iraq Desert in order to test some of the known methods of desert heating and to devise new ones, particularly from the Field Service point of view and to solve urgent and immediate problems.

MAIN PROBLEMS.

The absence of any form of solid fuel has made it impossible up till now to provide hot baths for patients or personnel. For the same reason "Hot cases" and resuscitation tents could not easily be improvised and there was entire dependence on expensive apparatus. At the same time the presence of burn cases in hospital from desert cookers, which are somewhat dangerous to handle, made one consider the possibility of devising a safety desert cooker. The solutions to some of these problems were found. However, although the oil fuel here appears to be completely successful it is naturally realized that only a full trial on active service conditions will provide real proof.

Economy.—To be of value it was thought that the essential requirements for the above schemes had to be readily to hand, preferably waste materials, or easily improvised. Moreover it was hoped to devise a fuel that would fulfil all demands of active service conditions.

Hygiene.—It was always kept in mind that the methods used should be of value and not a hindrance to effective sanitary control.

THE OIL FUEL.

Method.—The method devised for making this fuel is as follows. All refuse of any kind including dressings, dirty cotton-wool, paper, sandy floor sweepings, waste food, kitchen refuse of any kind, wet or dry, are placed in a strong receptacle such as a refuse bin. Crude oil or waste oil from motor car sumps is poured on and the whole mass mixed together. It is then beaten to a black pulp by stamping with a stout and heavy wooden pole. A handful of this fuel is wrapped very tightly in waste paper or cloth of any kind and fastened preferably with a piece of wire but a piece of string will do. The best size for big boilers is 9 inches by 4 inches but for sigris or improvised braziers and field cookers, "bricks" of about 4 inches by 2 inches will be found most suitable.

The points to notice are these : (a) Any refuse is suitable wet or dry and any oil, even of poorest quality, will do. (b) Very tight packing is essential to ensure slow and prolonged burning. (c) Proper stacking round an improvised funnel (a fruit tin with holes in it) is preferable to provide a continuous fire. (d) The residue is a small quantity of fine ash. (e) Fires can be easily started with paper or rag, with or without kerosene, but any inflammable material will do. (f) Bricks soaked in a little oil before use burn well. (g) One quart of oil is ample for making enough fuel to fill a kerosene tin. Excess oil is wasted.

Hygiene.—"Bricks" can be stacked and will not attract flies. All rubbish can be dealt with in this way and when mixed with oil will also not attract flies. This is also a profitable and easy method of rubbish incineration and such luxuries as drying platforms are not needed. The smoke given out does not have any objectionable odour.

Economy.—One sweeper can make forty large bricks in an hour. One gallon of crude oil is ample for the manufacture of 100 bricks. Ten bricks will continue burning for more than four hours with little attention and provide 500 gallons of hot water. The large iron boiler or salamander needs twelve to fourteen bricks to heat 60 gallons of water. The exact economy in using the oil fuel for cooking purposes has not been worked out but the method in my opinion appears considerably cheaper than oil cookers.

ALTERNATIVE METHODS.

If wire, waste paper or cloth be not available the fuel can be burnt in old tins which have had a number of holes cut in them. The fuel is well rammed down and the tins stacked round a central funnel. This method does not work so well as using "bricks" and more attention is needed to keep the fire going. But nevertheless it is an efficient substitute. Further experiments are being carried out to devise still further alternative methods.

IMPROVISED APPARATUS.

Designs that have been successfully tried out for the use of this fuel on active service conditions are described and illustrated. The question of screening from air has not yet been worked out.

CONCLUSION.

A method of making and utilizing a cheap and economical fuel for use on active service has been devised. The fuel is stable, portable, unaffected by exposure to rain or snow, easily burnt and can be quickly manufactured and utilized at once. Moreover, improvised apparatus for utilizing it on active service has been designed. An account of this scheme has been written before experiments have been completed since there is an urgent demand for fuel for many purposes and because experiments in this hospital appear to show that it is completely successful. The Officer Commanding this hospital, Lieutenant-Colonel H. A. Boyle, R.A.M.C., has given me every possible encouragement in these

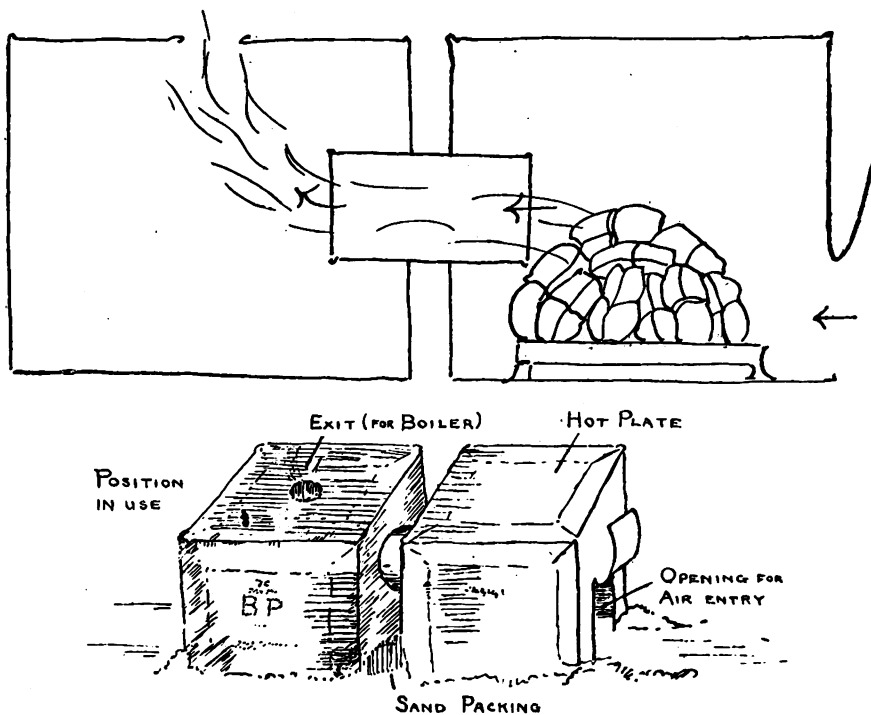
experiments and I wish to express my sincere gratitude to him both on that account and for permission to submit this article to the Editor of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS for favour of publication.

NOTE BY O.C.

"I have seen the above experiments carried out and I am very satisfied with the results achieved. As far as a hospital is concerned they fulfil a much-needed want, i.e. the rapid procuring of an adequate supply of hot water for almost all requirements."

NOTE BY A.D.M.S., BASE SUB-AREA.

"I was much impressed by these experiments, which I witnessed. The method appears to have real possibilities, particularly in a barren country such as Iraq, where coal and wood are at a premium and where oil, not forgetting waste engine oil, is procurable."



Design for double cooker. Materials required : Two kerosene oil tins, one fruit tin, one tin lid for incinerator tray.

IMPROVISED OIL COOKER.

The design is illustrated in the diagram. The apparatus can be made in a few minutes with a tin opener and two kerosene oil tins. The principle of the design is that the air from the windward side enters the first section of the cooker by a

special opening. The flames then pass through a fruit tin with top and bottom removed connecting the two sections. The second section is airtight except the hole at top. Three or four small oil fuel bricks are placed on incinerator tray on the ground and set alight by means of a little paper. In a few moments the bricks will be blazing and the first cover is put on. Immediately afterwards the second cover is fitted closely and air is excluded by sand being packed around the edges. The first half can be used for a Chaupatti plate or "thawa" and second for boiling.

The same principle is applicable to other uses as, for instance, braziers, etc.

A MODIFICATION OF A SIMPLE ETHER VAPORIZER.

BY MAJOR J. R. HAMERTON,

Royal Army Medical Corps.

A SIMPLE improvised anæsthetic apparatus for the administration of ether by the endotracheal route was described by Professor R. R. Macintosh and Dr. Freda Pratt in the *British Medical Journal*, of December 2, 1939 (p. 1077), and the diagram illustrates a modification described below. This modification overcomes certain disadvantages.

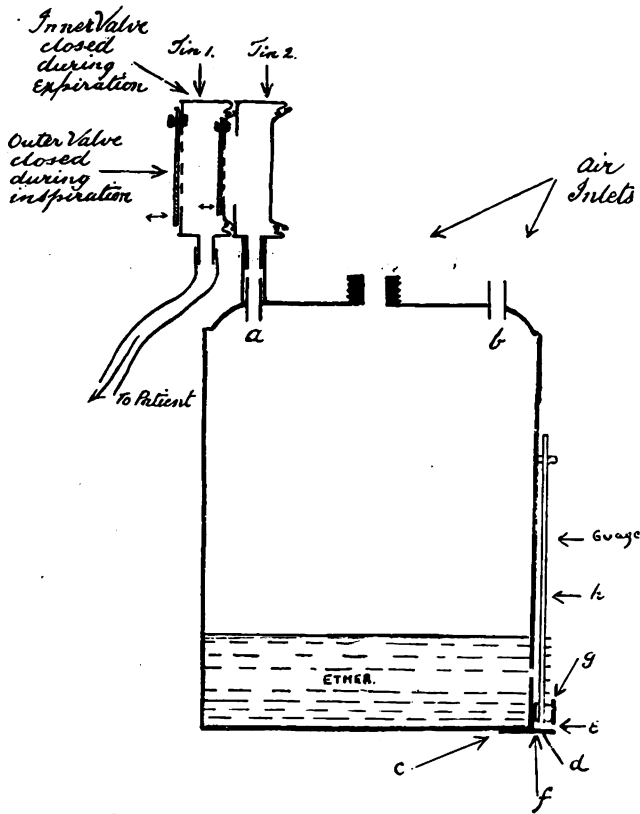
The apparatus originally described consists essentially of a metal canister of about 4 inches in diameter and 5 inches in height. Through the top are inserted and soldered two metal tubes of brass, which solders easily and does not rust. Each has a diameter of about $\frac{5}{16}$ inch, as shown in the diagram. The method of use is to anæsthetize the patient and to pass an endotracheal tube which is then connected to one of the tubes piercing the top of the canister. The breath of the patient passing to and fro over the surface of the ether, about 8 oz. of which have been poured into the canister, picks up a sufficient concentration of vapour to maintain tranquil anæsthesia.

Since a considerable amount of ether is lost by being passed into the atmosphere of the room with the current of expired air, a valve has been devised to divert each expiration so that it does not pass over the surface of the ether. Another modification consists of an easily constructed gauge, so that the amount of ether in the canister may be readily ascertained. It has been found that a considerable quantity of ether is saved by the use of such a valve. When the canister is used as originally described consumption of ether is about 3 oz. in ten minutes but when the valve is employed only a little over 1 oz. is consumed in the same period. These figures refer to young adult males and of course vary with the depth of respiration and duration of the anæsthetic. Further, since the moisture in the expired air is prevented from entering the canister, the thin sludge formed by condensed water and rust does not occur.

The "dead space" inevitable if no valve is used is eliminated.

The valve consists of two tins of about $1\frac{1}{2}$ inch in diameter and $\frac{3}{4}$ inch deep. If only taller ones are available, they may easily be cut down. It is immaterial

if the tins are of unequal size. Several perforations, about $\frac{3}{16}$ inch in size, are made in the bottom and lid of Tin 1, each series of holes covering a central area of about 1 inch in diameter. A hole 1 inch in diameter is cut in the bottom of Tin 2. The lid of Tin 1 is soldered by its rim so as to cover this hole. A short length of copper or brass tube is soldered over a $\frac{1}{4}$ inch hole made in the side of Tin 1, and a similar piece about $\frac{1}{4}$ inch long into the side of Tin 2 (See diagram.) These pieces of tube are of the same outside diameter as those soldered into the canister. The tube in Tin 2 is fitted with a tin sleeve, which is soldered into place. This enables the whole valve unit to be plugged with ease on to the canister.



Two discs of thin sheet rubber are cut ; a piece of an old Martin's bandage serves very well. Each disc is a little smaller than the inner surface of the lid and base of Tin 1 respectively. They are fixed by small screws and nuts to the perforated base and lid, suitable holes having been drilled for them.

Tins 1 and 2 are readily formed into one unit by inserting Lid 1, which has been soldered as described to Tin 2, into the open end of Tin 1. The lid of Tin 2 is replaced and the whole unit is then plugged on to the canister. The side tube soldered to Tin 1 is connected to the endotracheal catheter. The way in which

the valves work is simple and may be seen by reference to the diagram attached which also makes clear the above details.

The gauge is of simple construction. A small hole (c) is drilled in the side of the canister immediately above the base. A "V" or "U" shaped opening (d) about $\frac{1}{8}$ inch in depth is filed in the wall of one end of a short piece of brass tube (e), which is soldered vertically to the canister, the filed opening being opposite the hole punched in the canister, and care is taken that neither hole nor opening becomes occluded with solder. The lower end of the tube is sealed by a piece of tin (f) soldered into place. A short piece of rubber tubing (g) is inserted so that it fits snugly and is flush with the upper end. A piece of narrow calibre glass tubing (h), about 3 inches long, is fitted into this, making an ether tight joint. Both ends of the glass tube should be nearly sealed by a flame until the openings are but little larger than pin holes. The glass tube is supported at its upper end by a narrow strip of tin soldered on to the canister. Graduations are painted on the side of the canister behind the gauge to indicate the number of ounces of ether in the former.

Reference to the diagram shows that there are two inlets in the canister which, in the case of the apparatus made and illustrated, was an empty æther meth. tin, apart from that to which the valve is plugged. It was found by experience necessary to have both of these acting as air inlets for the tube soldered in acting alone did not provide sufficient air entry. Therefore if a tin which has not already one such opening is used in the construction of this apparatus, the tube forming the air inlet should have a diameter of at least $\frac{3}{8}$ inch.

In use, when an ether level of about 6 oz. is employed, a vapour strength sufficient to maintain good anæsthesia is inhaled. The vapour strength may be increased either by having a higher ether level, 12 oz. or more, or, if a rapid deepening of anæsthesia is necessary, the canister may be immersed in warm water. Oxygen or another gas may be easily added to the inspired air by connecting a cylinder to the tube in the canister which is acting as air inlet.

THE REMOVAL OF GREASE FROM ABLUTION WATER.

BY MAJOR G. V. JAMES,

Royal Army Medical Corps.

DURING wartime the exigencies of the Service often require a camp to be sited in an unsatisfactory position with regard to drainage, etc. In one such camp disposal of ablution and sullage water was by sumps dug into the ground. Owing to the nature of the soil no drainage occurred as a stratum of clay commenced at a depth of 2 feet and continued for over 30 feet, thus effectively retarding seepage. Poorly constructed grease traps further retarded any soakage.

The method of disposal advocated by Mackenzie and Hilton-Sergeant was thought to offer a possible solution and after several bench experiments it was

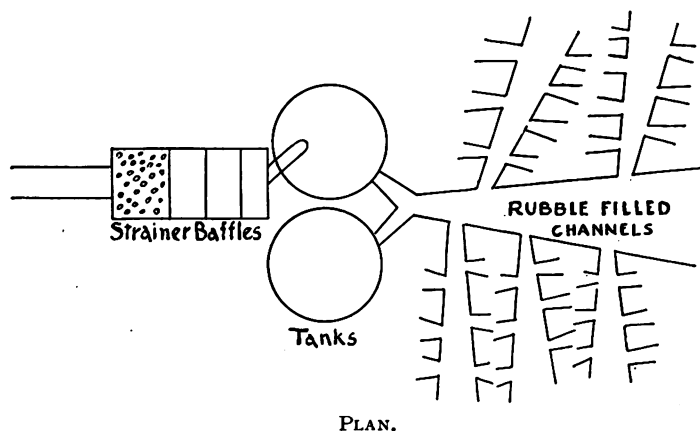
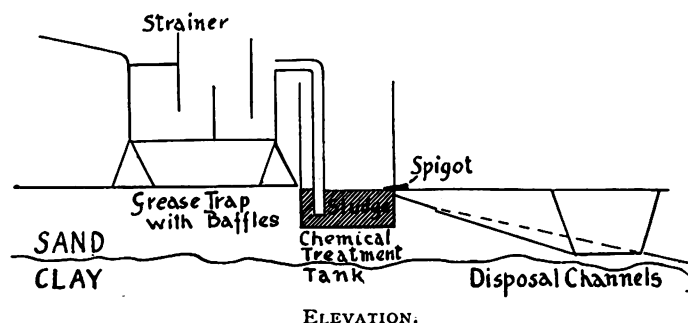
applied on a large scale to a sump and to an ablution bench where a small treatment plant was erected.

APPLICATION TO THE SUMP.

This sump was estimated to contain over 2,000 gallons of water. One and a half pounds of ferrous sulphate were dissolved in water and added to the sump with stirring, followed by one pound of lime, made into a suspension, the whole again being agitated and then allowed to settle. After a few hours the liquid appeared to be "brighter" in appearance.

Owing to the clay soil, much soakage was not likely to occur but the deposition of sludge assists such little soakage as takes place and also aids evaporation as the scum of grease on the surface is removed.

After two weeks the level of the water in the sump was seen to have fallen appreciably, the fall being more than double that of similar but untreated adjacent sumps.



APPLICATION TO AN ABLUTION BENCH.

The system was the passage of the waste water through a coarse strainer into a metal grease trap of the usual three baffle type. The effluent then entered one or other of two tanks (one tank collecting whilst the other was being treated). After treatment the liquid was discharged into rubble filled herring-bone channels. Details are shown in the accompanying diagrams.

The pipe conveying the waste from the grease trap to the treatment tank should reach almost to the bottom of the tank in order to mix the influent to the tank with the sludge already present. The pipe is transferred to the second tank when the first is full.

For every 100 gallons of liquid, 6 Horrocks box scoopsful of ferrous sulphate in solution were added, thoroughly mixed and then 5 Horrocks box scoopsful of milk of lime in suspension introduced. The whole was allowed to sediment for two hours and the supernatant liquid run off into the channels.

These channels increased in depth from the tank to their extremity but they never entered the clay substratum. As the depth increased so did the width in order that greater surface might be exposed for absorption. In herring-boned manner, but of the same type as the main channels, other side channels may be dug, all the channels being then filled with rubble.

Grease removal may be helped by facilitating evaporation and absorption into the soil as the grease cannot then clog the soil particles.

After the first use of the tanks the dose of chemicals can be reduced proportionally to the amount of liquid remaining behind with the sludge.

Periodically the tanks require to be emptied of their sludge. This may be done by the simple expedient of tipping into a pit. The volume of sludge is small and hence it takes a considerable time to fill the pit. A small amount of sludge should always be left behind in the tanks as this sludge hastens the precipitation reactions.

The method described was quite satisfactory in coping with the effluent from an ablution bench where about two hundred men washed. During the trial period of two weeks the effluent never failed to be absorbed.

ESTIMATION OF THE AMOUNT OF CHEMICALS REQUIRED.

In the field this may be done with a Horrocks box, ferrous sulphate, litmus paper, and lime, to ensure the correct conditions for treatment, as it is essential that the ablution water should be alkaline.

(a) Into the blue cup from the Horrocks box place one scoopful of slaked lime and make up to the mark with water. Stir well and use this solution when well mixed. (Do not allow the lime to settle before use.)

(b) Fill the six white cups with the ablution water and add to the first cup one scoopful of the suspended lime. Test for alkalinity with any convenient indicator paper (litmus paper). Add further scoopsful of solution to obtain an alkaline reaction. To the other five cups add the requisite amount of solution to obtain equal alkalinity.

(c) To the clear blue cup add one scoopful of powdered ferrous sulphate. Add a little water, dissolve the solid and make up to the mark. Mix well. To the first alkaline cup add one scoopful of ferrous sulphate solution, to the second cup add two scoopsful of solution, etc. The last cup will contain six scoopsful of ferrous sulphate solution. Stir well and allow to settle, noting the rate of sedimentation.

The sixth cup will show the quickest rate of sedimentation. Note this after

the cups have stood for a quarter of an hour. An equal value will be obtained from another cup after half-hour's standing which value is the one to use.

Possibly cup 4 shows this value. If so four scoopsful of ferrous sulphate have been used together with sufficient lime suspension to make the original ablution water alkaline.

SUMMARY.

The use of ferrous sulphate and lime is described and applied to a treatment plant for grease removal from ablution water for situations where the soakage from a sump or soakage pit tends to be poor.

A method is described whereby members of Field Hygiene Sections can estimate the amount of chemicals required for treatment and apply it to the process.

A PLASTER BANDAGE-MAKING MACHINE.

BY CAPTAIN G. J. CLELAND,

Royal Army Medical Corps.

THE making of home-made plaster bandages by hand is a slow procedure and the value of the bandages varies tremendously with the skill and care of the maker. The hands of those detailed to make the bandages become very rough. The simple apparatus described below has proved very effective in the rapid making of plaster bandages whose quality is uniform and of a high standard. It

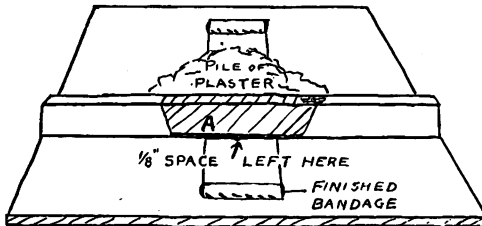


Diagram to illustrate machine for making plaster bandages.

has one other advantage, in that it can be made very easily by any unit in which machine-made bandages are unobtainable.

The following is a detailed description of the machine: This consists of a strong smooth board 24 by 15 inches on which is surmounted crosswise a block of wood 4 by 2 inches. This block is sectional and the centre piece is fastened by a hinge at one end. This centre section is 8 inches at the base and 10 inches at the top. This centre piece is $3\frac{7}{8}$ inches in height, leaving a gap of $\frac{1}{8}$ inch clearance space between it and the base board. The end of the bandage is passed under the centre piece and a heap of plaster of Paris is placed on top of the portion of the bandage on the other side of the centre piece. The bandage is drawn

through steadily and rolled loosely. It will be found that the bandage has become fully impregnated with plaster. The weight of the centre piece is found to be sufficient to impregnate the bandage, but a simple catch can be arranged at the loose end to prevent it rising as more plaster is drawn underneath.

The piece of wood A is hinged at one side and is thus capable of being raised. A bandage is placed on the board. A is replaced. A pile of plaster is placed on the bandage. When the bandage is pulled through the small space beneath A with a steady motion, it will bring sufficient plaster, well impregnated.

Current Literature.

HANNESSON, H. **A Case of Pulmonary Asbestosis Accompanied by Tuberculosis.** *Tubercle*. 1941, Feb., v. 22, No. 2, 40-44, 3 figs.

Pulmonary tuberculosis is found complicating asbestosis less often than it complicates silicosis, and appears later. Of ninety cases of death from asbestosis reported between 1933 and 1939, tuberculosis was present in thirty-two.

In a typical case the radiogram shows a fine diffuse fibrosis, beginning at the bases, and when complicated by tuberculosis the latter is distinguished as in cases of silicosis; the present case is of more than usual interest, first because the diagnosis was made during life, secondly because the radiogram did not show any definite evidence of pneumoconiosis, and thirdly because there was no macroscopic evidence of pneumoconiosis at autopsy.

The patient was a man aged 44, who gave a history, dating from five years back, of winter colds and bronchitis, loss of weight and once a large hæmoptysis. He was admitted with a diagnosis of pulmonary tuberculosis. For nine years he had been occupied as an "asbestos blower," a dusty occupation of passing asbestos fibre through a cleaning machine. Though provided with a respirator he did not use it. Physical examination revealed impairment of note over both lungs, diminution of breath sounds at the bases, crepitations fairly generally distributed; sputum contained tubercle bacilli and asbestosis bodies. X-ray yielded no evidence of pneumoconiosis but widespread nodular tuberculous infiltration with cavitation. The fingers were markedly clubbed. Twenty-five days after admission the patient had a spontaneous pneumothorax and died the same day.

Autopsy revealed thickened pleuræ, collapsed right lung with a cavity in the upper lobe which had perforated; macroscopically, the appearances were those of a pure tuberculosis. It will be seen, therefore, that the case recorded in this paper differs considerably from a typical case of pulmonary asbestosis; in the latter the pleural sacs may be completely obliterated by fibrous adhesions; the bases adhere firmly to the diaphragm; bronchiectasis is frequent, the lungs appear honeycombed, but firm, tough and airless. The upper lobes may be spongy, crepitant and emphysematous, strongly con-

trasting with the lower parts of the lungs. Microscopically, in this patient there were seen caseous tuberculous areas, reticular fibrosis of asbestosis most marked in the sub-pleural region, and a thickened pleura. Dr. Roodhouse Gloyne reported "Asbestosis bodies were numerous and large, many of them were in clumps with a radial arrangement. The presence of the asbestosis bodies implies a tissue reaction to the fibre, but it does not necessarily follow that this reaction is accompanied by fibrosis. The asbestosis bodies are an expression of tissue reaction of the nature of a benign irritant, and fibrosis of an appreciable extent may or may not be a part of that tissue reaction. Asbestosis bodies are the sign of tissue reaction to a foreign body just as much as phagocytosis, but the bodies should not be regarded as indicative of asbestosis unless they are accompanied by reticular fibrosis."

From the radiological aspect four stages of pulmonary asbestosis are distinguished; in the first, movement of the diaphragm is restricted; "the root shadows are unusually heavy and the basal linear striation on one or both sides is increased. The two sides of the chest are equally involved . . . some loss of translucency and a fine homogeneous opacity or haze at one or both bases."

"In the second stage the homogeneous opacity becomes more obvious and a fine punctate stippling may be detected at one or both bases, while the basal linear striation is more obvious, with very definite restriction of diaphragmatic movements and sometimes blurring of the diaphragmatic angles. The interlobar pleura is usually thickened and may be drawn down to the base by the fibrosis.

"In the third stage definite evidence of pleural involvement may be present, with or without mediastinal displacement, depending upon the irregularity of fibrosis in the two lungs.

"In the fourth stage the fine punctate mottling has spread beyond the limits of the lower zone to the middle and even upper zone, but the apices usually remain free. This fine diffuse mottling stands out in definite contrast to the coarse nodular mottling which is seen in silicosis." H. H. S.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 6.

HAWKING, FRANK. Sulphanilamide in the Treatment of Climatic Bubo and Similar Conditions.—*Jl. Trop. Med. & Hyg.* 1940. Dec. 2. Vol. 43. No. 23. P. 271. [Summary appears also in *Bulletin of Hygiene.*]

Sulphanilamide or some member of the sulphonamide group of drugs is now being tried in the treatment of almost any disease and it is only natural that venereal diseases should come within the category, especially since MacCallum and Findlay found that the mortality was lowered among mice so treated after infection with the virus of L.i.

The author gives brief details of four patients with L.i. The first, after receiving 63 grams sulphanilamide in fourteen days, left hospital with merely slight thickening of the inguinal tissues. Similar results followed

in another patient who received 27 grams in twelve days. A third received 41 grams in twenty-nine days, and the bubo was incised. The swelling subsided and the patient was discharged. The fourth had two coronal ulcers and climatic buboes, eighteen days' history. After twenty-two days' treatment with sulphone he left hospital, the buboes having subsided. They recrudesced and he returned. In all he received 81 grams over seven weeks and still had some residual swelling.

Eleven others had a closely similar history, so that, though some benefit followed, the curative effect cannot be said to have been very remarkable, in fact recovery was, generally speaking, no more rapid than in those who did not receive this form of treatment. With chancroid and granuloma venereum more favourable results were obtained, but the number of venereal cases in which the author has tried the drugs is at present small.

H. H. S.

Reprinted from "Tropical Diseases Bulletin," Vol. 38, 1941, No. 6.

BAKER, AUDREY Z. **Malignant Measles.** [Correspondence.] *Brit. M. J.* 1941, Mar. 8, 380.

"Black measles" is so rare that medical men are apt to forget its existence. The following case is, therefore, worth noting.

A child aged 9 months, when first seen by the author, had a temperature of 100·4° F., a slightly increased respiration rate and was apathetic. It was said to have vomited half an hour earlier. There was no rash. An epidemic of measles was in progress. Within twelve hours the child was *in extremis*, with cyanosis, rapid, shallow respirations and the whole body covered with a deep purple rash with petechiæ and purpuric areas up to $\frac{1}{2}$ -inch diameter. Death occurred in just over twelve hours after the child was first seen. The mother stated that she had not noticed anything wrong with the child prior to the vomiting. If this is correct, the illness ran its entire clinical course in thirteen hours.

H. H. S.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 6.

Reviews.

TROPICAL MEDICINE. Fourth Edition. By Sir Leonard Rogers, *K.C.S.I., C.I.E., LL.D., M.D., B.S., F.R.C.P., F.R.C.S., F.R.S.*, and Sir John W. D. Megaw, *K.C.I.E., B.A., M.B., Hon.D.Sc.* (Queen's University, Belfast). London: J. & A. Churchill, Ltd. 1942. Pp. xii + 536. Price 21s.

The publication of this edition, the fourth in twelve years and only three years after the third, clearly indicates the rapidity of the onward march of tropical medicine. It also indicates the keen desire of the authors to maintain the high reputation of this book in which they have achieved, even more successfully

than before, their ambition to provide a reliable guide to a sound elementary knowledge of the diagnosis and treatment of disease encountered in tropical countries.

This edition retains the attractive appearance and style of its predecessors and, although it seems little different, it will be found to have been extensively revised and in many parts rewritten. The chapter on malaria has been fully revised and a valuable chapter on dietetic diseases has been added. Throughout the book there have been included the results of recent research as, for example, the use of sulphanilamides in filariasis, plague, undulant fever and tropical ulcer, the value of diamidines in the treatment of kala azar and trypanosomiasis and much else. The addition of new material has somewhat lengthened the book but the authors have wisely refrained from enlarging the scope of the work and the printers, by adding one line to each page of the text, have reduced the number of pages.

There is little to criticize. It is unfortunate that the book had gone to press too early to include sulphaguanidine in the treatment of bacillary dysentery. In the article on typhus no mention is made of the important inapparent type of infection or of culture in eggs of rickettsia for the preparation of vaccines. In blackwater fever the colour of the urine is, in part, attributed to methæmalbumin instead of to methæmoglobin. Methæmalbumin is found in the plasma but is not excreted by the kidney. The dose of 0·02 gramme twice daily of plasmoquine is a little high even if given only for two days (p. 42), and does not agree with the dosage of this drug as given on a later page. A few inaccuracies of nomenclature are perpetuated from previous editions, orsamine and carbasone in place of orsanine and carbarsonè, and the correct spelling of the generic name of the molluscan host of *S. hæmatobium* is *Bulinus*. Printer's errors are few; some mistakes in page numbers are noted in the index.

These are minor points and this edition enhances the value of the book as a sound and trustworthy guide which is highly recommended to all medical men proceeding to tropical countries.

T. M.

MEDICAL DISEASES OF WAR. Second Edition. By Sir Arthur Hurst, M.A., D.M.Oxon., F.R.C.P. London: Edward Arnold & Co. 1941. Pp. iv + 427. Price 18s.

The first edition of this well-known work, in its new form, was published in 1940 and was fully reviewed in this Journal. In this second edition every chapter has been revised and brought up to date in the light of experience gained in 1940. Three excellent chapters have been added, one, by the author himself, on digestive disorders in soldiers, another on meningococcal fever from the pen of Colonel A. W. Stott and a third on malaria by Colonel H. B. F. Dixon of our Corps. In addition, a chapter on amœbiasis from the 1918 publication has been reintroduced in revised form. This volume has 100 more pages than the first edition.

In the description of *Entamœba histolytica* the size of this amœba is given as

from 15 to 60 μ . This is beyond the accepted limits of size of 18 to 40 μ for this parasite. In the article on malaria, it is stated of gametocytes that, "In benign tertian and quartan fever they are spherical, in malignant tertian crescentic. These forms of the parasite do not enter the corpuscles but remain free in the blood-stream." This is misleading since the gametocytes of all forms of human malaria are formed within red corpuscles although in many cases the mature crescents of *P. falciparum* would appear to have freed themselves from the envelope of the degenerated cell. Schizogony of this parasite is also stated to take either forty-eight or twenty-four hours. This would be better expressed as from thirty-six to forty-eight hours. Intramuscular quinine is condemned as dangerous and now universally given up. While there are many who subscribe to this view, it is considered that quinine given by this route has a definite place in the therapeutics of malaria and, in certain cases, may be much less dangerous than the intravenous administration.

The major portion of the book is, as before, devoted to the neuroses and functional disorders, particularly of the hysterical type, that are encountered under war conditions and of which the author gives an excellent description. The author and his collaborators are to be congratulated on this valuable and practical book.

T. M.

TEXTBOOK OF MEDICAL TREATMENT. Second Edition. Edited by D. M. Dunlop, B.A.Oxon., M.D., F.R.C.P.Edin., L. S. P. Davidson, B.A.Camb., M.D., F.R.C.P.Edin., F.R.C.P.Lond., J. W. McNee, D.S.O., D.Sc., M.D.Glas., F.R.C.P.Lond. Edinburgh: E. & S. Livingstone. 1942. Pp. xxiv + 1179. Price 25s.

There could be no better proof of the success of this book on rational therapeutics than the exhaustion of the first edition and an amended reprint in two years. This success is well deserved for the editors and the twenty-six contributors, all of them teachers in Scottish universities, have compiled a most valuable and comprehensive series of articles on modern medical treatment, giving reasons for the treatment and explicit directions for carrying it out—information which is usually glossed over or given only briefly in standard textbooks on medicine. In addition there is full and useful advice on the management of each case.

The new edition is even better than the first. New articles are included on the treatment of frost bite, immersion foot and trichinosis and on the therapeutic use of sex hormones. Throughout the book references to sulphonamide therapy have been brought up to date and this is comprehensively dealt with in the article on septicæmia. Many smaller emendations and improvements have been made. The book is fully indexed.

Medical practitioners in general, and especially those recently qualified, will find in this handy volume a great deal of important information which is not found in textbooks on general medicine and which is acquired only after years of experience. The book is very readable and the price is moderate.

T. M.

THE LIFE AND TEACHING OF SIR WILLIAM MACEWEN.—A CHAPTER IN THE HISTORY OF SURGERY. By Dr. A. K. Bowman, Regional Medical Officer to the Department of Health for Scotland. London, Edinburgh, Glasgow: William Hodge & Co., Ltd. 1942. Pp. x + 425. 21s.

The name of Macewen will be remembered for ever in the history of surgery. He was fortunate in that he lived and worked during the formative era when antisepsis, asepsis and safe general anæsthesia made possible the dramatic and far-reaching advances which are our inheritance to-day. To take part in and to guide this rapid evolution, to stimulate progress and at the same time to weigh and balance the inadequately considered and untried theories and methods of treatment, was a role which could be carried out only by an original thinker and a strong personality. Dr. Bowman has undertaken the task of showing in how far Sir William was successful in this respect.

As a student Macewen gave evidence of an extremely inquiring and critical mind and in his early days of practice as police surgeon he took every opportunity of probing into the "whys and wherefores" of such clinical problems as presented themselves, e.g. the condition of the pupil in alcoholic poisoning as an aid to diagnosis. Still later, as surgeon to the Royal and Western Infirmarys of Glasgow, he tackled his many problems in the traditional Hunterian methods of experiment, observation and deduction. No effort was spared, no trouble too great. An indefatigable worker, an accurate and acute observer and a systematic and clear thinker, he marshalled his facts and reached definite, if dogmatic, conclusions. Every part of the body and every aspect of surgical work presented to him problems of the utmost importance for solution. To mention a few of the better-known ones: bone, its growth and pathology; the brain, particularly pyogenic infections; aneurism; surgery of the chest; and schemes for the adequate training of nurses. Nothing but first-hand knowledge satisfied him; he worked by himself, for himself, without, however, any thought of financial gain. "Team" work, as we know it, was conspicuous by its absence. Dr. Bowman discusses this criticism of his "hero" and shows how impossible it was that such a team spirit could exist in one of Sir William's personality and original outlook.

Perhaps the best testimonial to Macewen is that most of the theories and methods of treatment worked out by him, without all the refinement of present-day research, have stood the test of time. The book, which gives the whole story in detail, will be read with pleasure and with profit by all who are interested in the history and progress of surgery.

W. A.

CARDIAC SYMPTOMS IN THE NEUROSES. By Doris M. Baker, M.D., M.R.C.P. Lond. London: H. K. Lewis & Co., Ltd. 1942. Pp. v + 49. Price 4s. 6d. net.

Left inframammary pain, sighing respiration and palpitation are three cardiac symptoms not infrequently found in the neuroses. These three conditions are discussed separately in this small volume. A table is given to assist in the differential diagnosis between angina pectoris and left inframammary pain. A. G. B.

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Original Communications.

A FACTOR INHIBITING THE AGGLUTINATION OF *BACT.*
ALKALESCENS BY HOMOLOGOUS SERUM.¹

BY MAJOR G. T. L. ARCHER,

Royal Army Medical Corps.

Two factors which possess the property of inhibiting somatic agglutination of the organisms in which they occur have been described in recent years.

The more important factor is probably the "Vi" antigen of *Bact. typhosum* described by Felix and Pitt (1934). The other, which also inhibits agglutination at 37° C. but not at 55° C. and is itself destroyed by heat at 60° C. for one hour, is the "V" antigen of streptococci described by Day (1933).

Since then Nabarro and Edward (1939) have recorded instances both from their own experience and from the literature of the failure of strains of *Bact. alcalescens* to be agglutinated. They refer, for example, to one strain which was not agglutinated when tested by Dr. W. M. Scott, but was agglutinated when examined by them.

The object of the present communication is to describe a substance occurring in certain strains of *Bact. alcalescens* which inhibits the agglutination of these strains but which, unlike the "Vi" and "V" antigens, has failed to show agglutinogenic properties on injection into animals and is not associated with enhanced virulence of the strains in which it is present. Agglutination tests have been carried out in Dreyer's tubes and, unless otherwise stated, at 50 to 55° C.

¹ Received May 16, 1941.

THE OCCURRENCE OF CLEAR AND OPAQUE COLONIES IN CERTAIN STRAINS OF *Bact. alkalescens*.

While examining certain strains of *Bact. alkalescens*, Colonel J. S. K. Boyd noted that some cultures were agglutinated by a serum kindly supplied by Dr. D. G. ff. Edward, while others were not, and that different cultures of the same strain did not always show constant results in this respect. He further observed that in the case of two strains he was investigating (viz. "8350" and "Towne") the colonies of each strain were divisible into opaque and clear. This difference was especially noticeable when the colonies were viewed by reflected light against a dark background. Subcultures from such colonies tend to breed true. Two other strains were examined however (viz. "Vince" and "Norfolk") which failed to produce two types of colony.

The strain "Vince" produced colonies which were all opaque, while those of the strain "Norfolk" were all clear. Finally he discovered that the rate of formation of alkali in milk varied in cultures from these different colonial forms, being more rapid in cultures derived from clear colonies, and that, whereas cultures derived from clear colonies were agglutinated to titre by Dr. Edward's serum, cultures derived from opaque colonies were not. An example of the agglutination results is shown in Table I.

TABLE I.

RESULTS OF AGGLUTINATION TESTS ON DIFFERENT CULTURES OF *Bact. alkalescens* CARRIED OUT BOTH AT 37° C. AND 55° C. AND USING A *Bact. alkalescens* SERUM SUPPLIED BY DR. EDWARD AT DILUTIONS BETWEEN 1/200 AND 1/1600.

SUSPENSION	TITRE
Formolized wash from Agar Plate.	
<i>Bact. alkalescens</i> "Towne" "clear"	1/1600
" " " "opaque"	<1/200
" " "8350" "clear"	1/1600
" " " "opaque"	<1/200

At this stage Colonel Boyd was unable to continue this work and handed the investigation over to me.

FURTHER EXAMINATION OF "CLEAR" AND "OPAQUE" CULTURES OF *Bact. alkalescens*.

Agglutination tests were repeated using both broth cultures and suspensions of agar cultures of both types.

In view of the group relationship reported by Boyd (1940) between *Bact. alkalescens* and his type P. 274, serum prepared against the latter was used in addition to alkalescens serum.

Finally, to determine the presence of any relationship with the Flexner group, serum prepared against *B. dysenteriae* Flexner IV (Boyd 1940), which had a high group titre, was also used.

The results showed that while "clear" cultures were always agglutinated by the homologous serum, "opaque" cultures varied. It appeared at

first that while broth subcultures from opaque colonies were agglutinable to a greater or less extent, saline suspensions of subcultures of such colonies on agar were inagglutinable; on this account I thought that the inhibitory factor was a substance which was readily autolysed in fluid cultures. Further tests however showed that these results did not represent a constant difference in behaviour.

Agglutination by P. 274 serum and by Flexner IV serum occurred to a low titre only with the Flexner serum and with one of two P. 274 serums. A moderate titre was shown by another (presumably less specific) P. 274 serum. All such results were similar to those obtained with homologous serum, however, in that "clear" cultures were agglutinated, whereas such "opaque" cultures as were not agglutinated by the homologous serum were also inagglutinable by the heterologous serum, i.e. the "opaque" is not a group variant. If, on the other hand, the "opaque" were the specific variant and the "clear" the group the absence of specific antibody from the homologous serum as demonstrated by its failure to agglutinate "opaque" suspensions would be surprising.

EXAMINATION OF CULTURES FOR ROUGH VARIATION.

It was possible that the failure to develop agglutinins for the opaque variant was associated with the S—R phenomenon such as occurs so rapidly with *B. dysenteriae* Sonne and much more slowly with *B. dysenteriae* Schmitz (Boyd 1936). The different types of colonies noted on plate cultivations were, therefore, examined for their rough and smooth qualities. It was found, however, that the clear-opaque variation was not closely correlated with the S—R changes which occurred. In general such changes were more commonly seen in the clear variant, but both smooth-clear and rough-opaque colonies were observed.

The fact that R variation is sometimes associated with changes in biochemical activity, and the early findings of the more rapid production of alkali by the "clear" variant, led to a further series of tests of the biochemical reactions of both variants.

The sugar reactions were as follows and were constant:

Lactose	Glucose	Mannite	Dulcitol	Saccharose	Indol
—	A	A	A (48 hours)	—	+

The rate at which alkali was formed in milk showed on the other hand a constant difference, the change from an acid to an alkaline reaction being complete in from two to four days with subcultures of clear colonies and from seven to nine days with subcultures of opaque colonies.

MORPHOLOGY.

In view of the possibility that variation in agglutinability might be associated with morphological differences, more especially with the presence or absence of capsules, films of various clear and opaque cultures were

examined. Staining by Gram's method revealed no constant differences in morphology. Neither could I demonstrate the presence of capsules in films of either variant by the use of Muir's stain or of Indian ink preparations.

**PRELIMINARY ATTEMPT TO PRODUCE DIFFERENTIAL ANTI-"OPAQUE"
AND ANTI-"CLEAR" SERUMS.**

Suspensions of "clear" and "opaque" strains of *Bact. alkalescens* (No. 8350) were prepared and were injected intravenously into rabbits for the production of antiserum. The results are shown in Table II and it will be seen that there is no appreciable difference in the ratio of the titres of either serum for the two suspensions.

SERUM	TABLE II				SUSPENSIONS	
					"8350" "clear"	"8350" "opaque"
"Opaque"	1/800	1/160
"Clear"	1/3200	1/320

**THE STABILITY OF THE INHIBITORY FACTOR PRESENT IN "OPAQUE"
CULTURES.**

Discrepancies in agglutination results obtained by Colonel Boyd, working at 37° C., and myself, when using a water bath at 55° C., suggested that temperature was a factor affecting the occurrence of agglutination of "opaque" suspensions of *Bact. alkalescens*. In view of this consideration and of the nature of the "Vi" and "V" antigens, it now seemed desirable to carry out tests to ascertain the *stability* of the factor inhibiting the agglutination of "opaque" *alkalescens* cultures.

(1) *The Effect of Age.*

It is to be noted that the suspensions employed in the experiments recorded in Table II were formolized suspensions some six weeks old. The

TABLE III

VARIATION IN AGGLUTINABILITY DUE TO AGE OF FORMOLIZED SUSPENSION AND TEMPERATURE AT WHICH TESTS WERE CARRIED OUT.

(Titres are expressed as percentages of the titres of the serum obtained when tested against normal or "clear" cultures).

Temperature	Culture	Age of Formolized Suspension	Percentage Titre
55° C.	"Vince"	Fresh	<5
		One week	<5
		Three weeks	100
		Five weeks	100
	"8350" "Opaque"	Fresh	<20
		Six weeks	20
		Sixteen weeks	100
37° C.	"Vince"	Fresh	<5
		Five weeks	<5
	"8350" "Opaque"	Fresh	<5
		Five weeks	<5

possible influence of the age of the suspension on agglutinability was further investigated. In Table III are records of agglutination tests, employing suspensions of different ages showing quite clearly that, within limits, the agglutinability of opaque suspensions is related to the date of their preparation.

(2) *The Effect of Heat.*

(a) *Temperature at which the Test is Conducted.*—The second part of Table III demonstrates that in suspension of the same age the agglutinability is increased if the test is carried out at 55° C. instead of 37° C. These results have been confirmed by testing the agglutinability of other "opaque" suspensions at these two temperatures and four out of six of such suspensions, although completely inagglutinable at 37° C., reacted to 20 to 80 per cent of the normal titre of the serum when the test was carried out at 55° C.

(b) *Effect of Heating Suspensions before Testing.*—Different portions of "opaque" broth cultures of the three strains producing this variant were (i) formolized, (ii) heated at 55° C. and (iii) boiled. The suspensions thus treated were tested against stock serum. It was found that suspensions which were inagglutinable when merely formolized became perhaps slightly more sensitive to agglutination after heating at 55° C., and *highly sensitive after boiling*, when they were agglutinable to a high percentage of the titre of the serum.

Bearing out the previous observation it was found that the contrasting results in this test were more clear cut when it was performed at 37° C. rather than at 55° C. At the latter temperature certain formolized suspensions, *though refractory for approximately two hours by which time agglutination of their boiled counterparts was well marked*, upon further incubation became agglutinated to a fairly high titre.

(3) *The Effect of Treatment with Various Reagents.*

(a) *Chloroform.*—The inhibiting substance presumably present in "opaque" suspensions is rendered ineffective and agglutination of suspensions treated with chloroform occurs.

(b) *Ether.*—This is less effective than chloroform in promoting the agglutinability of "opaque" suspensions.

(c) *Acid* (followed by neutralization after twenty-four hours).—This is as effective as chloroform. The inhibitory effect is destroyed.

(d) *Alkali* (followed by neutralization after twenty-four hours).—The effect is doubtful as in the only tests made a degree of auto-agglutinability was induced.

Chloroform and acid appear to be as effective as boiling in promoting the agglutinability of "opaque" variants.

Thus the agglutination-inhibiting factor occurring in opaque colonies of *Bact. alkalescens* resembles the "Vi" antigen of *Bact. typhosum*: (i) In its effect on somatic agglutinability; (ii) In its instability, especially in its ready destruction by heat; (iii) In the relative opacity of colonies in which

it is present. This has been noted for "Vi" colonies of *Bact. typhosum* by Craigie and Brandon (1936).

It was therefore desirable to attempt again to demonstrate whether or not this factor, like the "Vi" antigen, possesses antigenic properties.

FURTHER ATTEMPT TO PRODUCE ANTI-"OPAQUE" SERUM.

It is obvious that the result of the first attempt to prepare anti-"opaque" serum was inconclusive because the inoculum used was a killed suspension employed over the whole period of immunization and hence was an unsuitable source of antigen of the "Vi" type. A further attempt to produce anti-"opaque" serum was therefore made using living cultures of the "Vince" strain and living "opaque" cultures of the "Towne" strain as inoculums. The presence of the inhibiting factor in each inoculum was demonstrated by agglutination tests, supported in most cases by observations on the rate of alkali production in subcultures in milk.

The serums obtained on bleeding the immunized rabbits were titrated, both before and after absorption, against "opaque" suspensions at 37° C. and 55° C. They were absorbed with a "clear" culture of the "8350" strain or with a culture of the "Norfolk" strain.

In case the absorbing suspensions should contain inhibiting substance in the saline in which they were suspended absorption was repeated using suspensions of the "clear" variant of the "Towne" strain and a further suspension of the "Norfolk" strain both of which had been washed. Control titrations of the serums, against "Norfolk" suspensions, were also carried out.

The results which, together with those given by stock serum as a control, are shown in Table IV, show that the inhibiting substance present in opaque variants of *Bact. alkalescens* is not itself antigenic, and thus is unlike the "Vi" antigen of *Bact. typhosum* in this respect.

TABLE IV
Tests at 37° C. overnight Tests at 55° C. for 4 hrs.

+ SERUM	SUSPENSIONS						
	"Norfolk"	"Vince"	"Towne"	"8350"	"Norfolk"	"Vince"	"Towne"
"Towne"	1/10,000+	1/320 tr	1/160 tr	1/80	—	1/160	—
"Towne" Absorbed with "8350" "clear"	—	1/80 tr	0	1/40 tr	1/320	0	—
"Towne" Absorbed with "Towne" "clear" (washed).	—	—	0	1/40 tr	—	—	—
"Towne" Absorbed with "Norfolk" (washed).	—	—	0	0	—	—	0
Stock	1/1280	0	0	0	—	1/640 tr*	—
"Vince"	1/10,000+	1/80	1/80 tr	1/40	—	1/40	—
"Vince" Absorbed with "Norfolk"	—	0	0	0	1/40	0	—
"Vince" Absorbed with "Towne" "clear" (washed).	—	—	—	—	—	—	1/80 tr
"Vince" Absorbed with "Norfolk" (washed).	—	—	0	0	—	—	1/40 tr

* after 8 hours.

0 after 3 hours.

THE VIRULENCE OF OPAQUE AND CLEAR CULTURES OF *Bact. alkalescens*.

Tests were now carried out with a view to determining whether or not the presence of the agglutination-inhibiting substance is associated with a change of virulence.

The probability of a negative result was suggested by the results reported by Edward (1940) since he found no significant difference in virulence between cultures of strain "Norfolk" and strain "Vince." The M.L.D. for mice according to him was 0.5 milligram of fresh culture. This dose is approximately equivalent (as estimated by Brown's Table) to a count of 1,500 million organisms calculated as *B. dysenteriae* Flexner.

In a preliminary test, therefore, I used doses of $1,000 \times 10^6$, $2,000 \times 10^6$, and $6,000 \times 10^6$. The organisms were given intraperitoneally suspended in saline. The strains used were "Vince" and "Norfolk" since they are the strains which respectively maintain their "opaque" and "clear" character. Three mice were used for each dose of each strain; only three of the total of eighteen seemed likely to survive after nineteen hours. Of these one had received $2,000 \times 10^6$ "Vince" and the other two $1,000 \times 10^6$ "Norfolk."

The doses were thus too high for the estimation of a possible difference of virulence. Another series of mice was therefore given doses of 250×10^6 , 500×10^6 , and $1,000 \times 10^6$. Two mice were used for each dose of each strain. Four of the twelve mice used died, one following the maximum dose of "Vince," the other three following doses of "Norfolk." These latter were the two which received the maximum dose, and one of the two which received a dose of 500×10^6 .

Finally eight mice for each strain were given doses of 250×10^6 and five mice for each strain were given $1,000 \times 10^6$. Of the eight mice receiving the smaller dose of each organism one died in each series. Of the five mice receiving the larger dose, one of the "Vince" series and three of the "Norfolk" series died.

In each case the inoculum was subcultured as a test of purity. All proved to be pure, and tests for agglutinability carried out on the subcultures showed that in each case "Vince" was inagglutinable at 37°C . while "Norfolk" was agglutinated normally at this temperature.

The inoculums used for the second series were also tested for alkali production. This occurred in forty-eight hours in the culture of the "Norfolk" strain, but was only starting after seventy-two hours in the culture of the "Vince" strain. It should be noted that on this occasion the colonies of both strains were rough the "Vince" colonies being more so, and the differentiation of clear and opaque colonies was not well marked.

The results of these three experiments, simplified by the exclusion of the two mice for each strain inoculated with 500×10^6 , and the combination

of the results obtained with doses of $2,000 \times 10^6$ and $6,000 \times 10^6$, are summarized in Table V.

TABLE V
THE VIRULENCE OF "OPAQUE" AND "CLEAR" STRAINS OF *Bact. alkalescens* FOR MICE.

Strain	Dose of organisms in millions	No. of Mice inoculated	RESULT	
			Dead or Dying	Survivors
"Vince"	250	10	1	9
	1000	10	5	5
	2000	6	5	1
	or 6000			
"Norfolk"	250	10	1*	9
	1000	10	5	5†
	2000	6	6	0
	or 6000			

* A very small animal.

† One however destroyed as very sick and unlikely to recover.

While the numbers used are insufficient for an accurate quantitative virulence test the results suggest that there is no significant difference in the virulence of these strains. They thus support the findings of Edward, while the actual figures are approximately in accordance with the M.L.D. as determined by him.

SUMMARY AND CONCLUSIONS.

(1) The variation in agglutinability of different strains, or cultures of a single strain, of *Bact. alkalescens* is shown to be associated in certain cases with a difference in the opacity of the colonies of such strains or cultures on agar, suspensions derived from opaque colonies being resistant to the action of serums which agglutinate suspensions derived from clear colonies.

(2) This variation in agglutinability is not associated with any readily demonstrable morphological differences in the strains which exhibit it, but does appear to be associated with some differences in biochemical activity.

(3) The inhibiting factor responsible for the inagglutinability of the opaque strains bears a superficial resemblance to the "Vi" antigen of *Bact. typhosum* and the "V" antigen of streptococcus in its thermolability but there is no evidence that this factor is antigenic or associated with any altered virulence of the organism.

(4) While the possibility of such inhibition should be borne in mind when failure of agglutination of a culture which morphologically and biochemically resembles *Bact. alkalescens* is observed, I do not suggest that this is the explanation of such failure in all cases, or that this species exhibits serological uniformity. Indeed the contrary appears to be the case since the inagglutinability by stock serum of two strains ("Smith" and "Oddy"), kindly sent to me by Dr. Edward, is unaffected by boiling and hence cannot be due to a thermolabile inhibiting factor.

ACKNOWLEDGMENTS.

I wish to thank Lieutenant-Colonel H. T. Findlay, R.A.M.C., for very kindly carrying out independent examinations of the morphology of "clear" and "opaque" strains and confirming the absence of capsule formation, and Dr. D. G. ff. Edward for supplying various cultures and serums.

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CLINICAL LECTURE ON LEPROSY: WITH NOTES OF THREE CASES AMONGST MALTESE TROOPS.¹

BY COLONEL H. B. F. DIXON, M.C.

GENTLEMEN.—During the past two and a half years there have been three cases of leprosy among Maltese troops (two of them in the last three months) and, in view of the general call up of the population, we may get some more. I thought that this would be a suitable opportunity to give a short talk about leprosy, especially to those of you who may not have tropical experience and have recently arrived on the Island. I have done this mainly with a view to stimulating interest in the subject and have had the greatest assistance from Dr. Toledo, the Medical Officer of St. Bartholomew's Hospital, who would be very pleased to see any M.O. interested and go into the subject more deeply than I can hope to do.

Definition.

Leprosy is a chronic disease caused by the acid-fast *Mycobacterium lepræ*. The chief feature of the disease is the formation of granulomata which occur chiefly in the skin and nerves and cause slowly developing deformities and trophic lesions.

There are two types of this disease:

The lepromatous type which attacks the skin and mucous membranes and often ends in death after a prolonged illness usually from some intercurrent disease.

The neural type which attacks the nerves and in which the infection tends to die out leaving, in many cases, permanent crippling of hands and feet.

History.

According to Muir (1938) Africa is credited with being the birthplace of leprosy, the first recorded cases being slaves from the Soudan some 1350 B.C.

A description of leprosy is found in the "Rig Veda" sacred books of India 1500 B.C.

Chaulmoogra is mentioned in pre-Buddha legends as a cure for leprosy 300 B.C. The Leper Asylums in England founded by the Ecclesiastical Authorities in the middle ages were the beginning of our present hospital system and our method of isolation and notification.

The Order of St. Francis (Franciscan Friars), from the earliest period of their foundation, devoted themselves to the care of sufferers from leprosy.

¹ A clinical lecture delivered at a meeting of the Malta Medical Services Clinical Club, at Imtarfa, Malta, on August 28, 1941.

History of Leprosy in Malta.

The official report of the Health Conditions of the Maltese Islands by the Chief Government Medical Officer, Professor Bernard (1937), contains much valuable information on the history of leprosy in Malta and I am indebted to his report for most of the information in the following paragraphs.

It would appear that, despite its geographical position mid-way between Europe and Africa and its extensive trade with the Levant, there is no definite record of leprosy in Malta until the middle of the last century. The records of the oldest hospital of the Island, the Santo Spirito Hospital, which formed part of the Monastery of the Order of St. Francis, are extant since the fourteenth century but there is nothing in these records mentioning leprosy.

The Knights of Malta (1530-1798) had a most excellent hospital in Valletta with a special skin department for syphilis and tinea, but there are only vague references to leprosy persons in the regulations of the Order in the years 1704-1725.

There is no reference to leprosy in the medical writings or in the common law of the Island during the period when the Knights ruled. It is believed traditionally that there were some imported cases in 1687 and in 1808 and some local cases in 1837 but these cannot be verified.

In 1862, in reply to a questionnaire sent out by the Royal College of Physicians, it was officially stated that leprosy did not exist in Malta. In the next twenty years, however, cases were noted and official action taken in 1893 when special legislation was enacted, making notification and segregation compulsory, and a Leper Hospital was built. There were about 61 cases officially known at that time.

In 1919 a further commission was set up which modified some of the severe legislation regarding lepers and the present law is:

(1) Any person suspected of leprosy is examined by a board of medical officers and if found to be contagious is detained by law in the Leper Asylum.

(2) If not contagious he is not segregated but must by law undergo treatment and periodical re-examination.

(3) As soon as the segregated case becomes non-infective he is examined again by the board and discharged, to attend for re-examination every six months.

(4) Lepers discharged from hospital are not allowed to engage in certain occupations.

The Leprosy Hospital in Malta, now known as St. Bartholomew's Hospital, is maintained on very generous lines. It is a spacious stone building with ample ground attached, including 20 acres of agricultural and reclaimable soil.

There is a Resident Medical Officer and the nursing is carried out by Sisters of Charity assisted by male and female nurses under the Medical and Health Department.

Every form of modern treatment is available and I was very much struck on my frequent visits there with the care and attention the patients received. I was very much impressed, also, with the cheerfulness and contentment of the inmates.

The average number of patients is 68, 42 male and 26 female. Most of the cases are of the lepromatous type and come mainly from the villages of Qurmi, Zurrieq and Mellieha. Many of them have had relatives in hospital at some time or another. The families of male patients receive a generous subsidy from the Government. The average number of patients attending for out-patient treatment is 40.

There is a branch of St. Bartholomew's Hospital at Fort Chambray, Gozo. There were 22 patients there at the time of writing, 14 males and 8 females, thus the number of known lepers in Malta is:

In St. Bartholomew's Hospital	...	...	...	68
In Fort Chambray (Gozo)	...	...	...	22
Attending as out-patients or under observation	...	...	...	40 (approx.)
				<hr/> 130 <hr/>

It is considered, however, that, if a complete survey were done on modern lines, the number of lepers in the Maltese Islands would be much greater, possibly 260, i.e. 1 per 1,000 of the population.

Leprosy in England.

Rogers, Cook and Muir (1940) state that there have been 87 known cases of leprosy in England during the past 30 years of whom all except 4 contracted the disease out of England. The four cases which contracted leprosy in England did so as the result of close continuous contact with known lepromatous cases who had been infected abroad. One was a conjugal case and the other three children. Only 40 of the 87 recorded cases are apparently alive. Of these 18 are non-infectious neural cases and 22 lepromatous of whom all but 4 are under careful observation and segregated.

The only residential leper colony in England is St. Giles' Leper Home in Essex. It is a voluntary hospital and there is accommodation for twelve patients; it was founded in 1913 and is maintained by voluntary subscriptions. The nursing is done by an Anglican Order, the Community of St. Giles. In 1940 there were five patients in the Colony.

Leprosy in the British Army (British Troops).

Only two cases have been recorded in the last ten years, one a soldier born in India reported by Harrison (1938), the other a soldier who developed leprosy in England seventeen years after leaving the Army.

Geographical Distribution.

The geographical distribution is world wide, but the disease is most prevalent in backward countries. It still lingers in Europe—Sicily, Spain, the Balkans and the Scandinavian countries. It is said to be on the increase

in Finland. From being a world wide disease it is now mainly confined to the tropics and most references to leprosy are found under tropical diseases. It is estimated that there are 5,000,000 lepers all over the world. Curiously enough Malta is not mentioned in any textbook that I have consulted.

Epidemiology and Endemiology.

Age—It is considered by many experts that infection only takes place in childhood. It is rare after puberty.

Social and Hygienic Conditions.

Leprosy is a disease that gets hold of communities that have been on a low level of personal hygiene and sanitation. It is a disease of the crowded house, room and bed. The more crowded and insanitary these are the more likely it is to spread. Leprosy again tends to disappear when a certain standard of sanitation and living is reached.

It is well said that leprosy is a disease of semi-civilization. It is uncommon among the wild nomads of Africa and the primitive tribes of India; it is equally uncommon among highly civilized peoples.

It would appear that when the savage commences to wear clothes and live in houses leprosy begins to appear—the fringe of civilization appears to be fertile ground for its dissemination. Muir (1939) attributes this to weakening of tribal control whereby there are increased facilities for mixing outside the tribe, and also inside it, leading to (1) overcrowding; (2) change of diet and the substitution of imported foods for home grown; (3) change of clothing and manner of life; (4) those who have been naked suddenly adopt clothing which is promiscuously shared and not kept clean; thus the family shirt becomes the spreader of disease.

Diet.

That diet is an important factor in the causation of leprosy is held by some authorities. Whether the factor is an avitaminosis or merely an insufficient diet lowering resistance is not quite clear.

It is well known however that most lepers improve without medicinal treatment when their resistance is raised by a well balanced full and generous diet.

Climate.

Is in no way a cause. Leprosy exists in all climates but it has some influence in determining the type of the disease. In a cold climate it usually assumes the lepromatous form, in the tropics the neural form.

Ætiology.

Causal organism—*Mycobacterium lepræ*.

How Acquired.

The disease is usually acquired by close continuous contact with lepers who have open lesions, either ulcerating nodules or nasal discharge. The

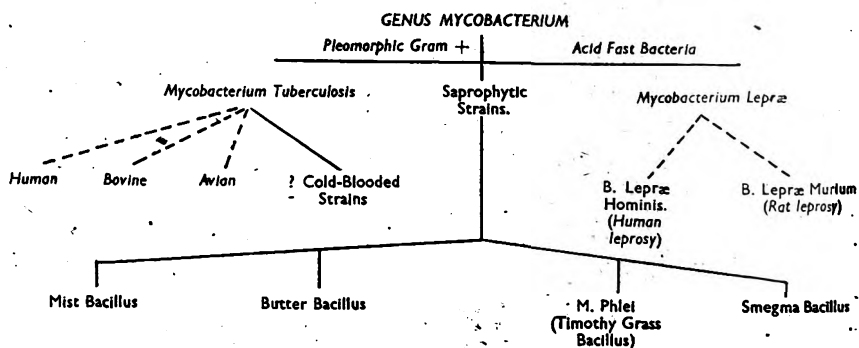
portal of entry of the bacilli is most probably through the skin or possibly through nasal mucous membrane.

The mechanism in the case of skin infection is probably through abrasions caused by insect bites or through small abrasions normally acquired by bare-footed agricultural workers and fishermen. The picking of the nose by small children may possibly introduce the bacilli through the nasal mucous membrane.

Of the two types, lepromatous and neural, the lepromatous is much the more infective.

Bacteriology.

M. lepræ is found in all primary leprous deposits of the lepromatous form and in the nodule in prodigious numbers. In size, shape and staining reactions it is pleomorphic and closely resembles *M. tuberculosis*—it is Gram + and not so acid fast as T.B. It has not yet been grown in culture media nor has it been successfully inoculated into man or lower animals and consequently does not fulfil Koch's postulates. It is non-pathogenic to other animals.



Special Pathology.

The bacilli invade a certain area of the skin either by local inoculation or through lymphatic spread from a deep seated focus.

Neural Type.—The first reaction is that of mild inflammation and round cell infiltration. If the lesion is progressive the macrophage appears. If the resistance of the patient is high two developments are seen: (1) A tendency to focalize the inflammatory process; (2) the development of epithelioid and giant cells.

These are the cells seen characteristically in the neural forms and the nerves of the skin are seen to be invaded by the same type of cell.

The invasion of the larger nerves is probably due to lymphatic spread or ascending infection from the skin—the nerve becomes swollen, tender and later thickened.

The histology of the skin lesions in neural leprosy is: (1) focalization of the process in the skin, foci being chiefly perifollicular and perivascular;

(2) formation of epithelioid and giant cells; (3) invasion of subcutaneous nerves and larger deep nerves, ulnar, peroneals, etc.

Lepromatous Type.

Instead of an attempt to shut off the bacilli by focalization, the bacilli owing to the relatively lowered resistance of the tissues multiply, the macrophages become active cells and phagocytose the bacilli and these cells are called lepra cells; these are seen uniformly distributed under the epidermis.

The granuloma in the lepromatous type shows little tendency to invade subcutaneous nerves—bacilli may be found in the nerve sheath but they do not give rise to active reaction on the part of nerve tissue.

Histological appearance thus is: (1) No focalization of the granuloma; (2) lepra cells—no giant or epithelioid cells; (3) nerves not invaded.

In other words the bacilli appear to multiply with little attempt on the part of the tissues of the body to localize the infection hence the frequent comparative slightness of the clinical signs in the lepromatous type.

The process continues until all skin elements are involved, including the whole subcutaneous tissue except the subcutaneous nerves.

A change takes place in the lepra cells which become fixed tissue cells and undergo foamy degeneration with vacuoles (the foamy cell of Virchow).

General Pathology.

It is not definitely known whether there is a bacillæmia or not but bacilli can be found in the liver, spleen, bone marrow and lymph glands in all cases where the disease has become generally disseminated. It is probable that bacilli would be found in the internal organs in the majority of cases of the lepromatous type even after the outward signs have disappeared. No macroscopic lesion however is found in the organs, as the bacilli occupy the wandering cells without giving rise to any gross pathological change. The bacilli live in a state of almost perfect commensalism in the cells of the reticulo-endothelial system. No vital organs are, however, attacked but testicles, trachea, larger bronchi, palate, throat, nose and eyes may be affected.

The testicles become inflamed, enlarged and ultimately fibrotic, resulting in destruction of the organs and this accounts for the extreme cases of gynæcomastia sometimes seen. Lepromatous infection of the throat not infrequently results in stenosis of the larynx and death if tracheotomy is not performed.

Affections of the palate and nose result in perforation and extensive deformity. Affections of the eye tend to cause extensive damage and blindness.

Leprosy is one of the most mutilating of diseases, nevertheless patients seldom die of leprosy but of some intercurrent disease.

Clinical Picture.

Incubation Period.—There is not, properly speaking, an incubation period; it is more truly described as a latent period. It may range from three months to forty years depending on the resistance of the patient.

Prodromal Stage.—Fever of greater or less intensity appears, recurring more or less frequently. Febrile attacks with weakness and drowsiness may be mistaken for malaria or undulant fever; dyspepsia, epistaxis, dryness of the nostrils, rhinitis, headache, perversions of sensation, "pins and needles," general aching, rheumatic pains may occur, all of which may herald the explosion of unequivocal leprosy.

The Primary Exanthem.

The appearance of the macules is usually the first positive clinical sign in all forms of leprosy. These may be erythematous or hypopigmented. They may be elevated above the surface with or without a definite periphery. There may be a loss of hair in the affected area. The most common sites of the macules are the face; superciliary region, nose, cheeks, ears, chest, buttocks and abdomen. Mucous membranes are seldom attacked at this stage. In some countries nodules may be the first clinical sign in lepromatous cases.

NOTE.—The term macule in leprosy has not the same significance as in dermatology. In the terminology of leprosy the term "macule" signifies a circumscribed area of skin of abnormal colour, usually hypopigmented, sometimes hyperpigmented and often erythematous.

It is used without regard to the presence of infiltration or elevation.

It is specially applied to the skin lesion in the neural type of leprosy but may be used to designate lepromatous patches.

Stage of Specific Deposit. (a) Lepromatous Type.—After the primary exanthem the next stage in the process is the formation of the nodules, varying in size from a split pea to a great plaque many inches across. The colour varies from a red or dirty pink to a dark brown or dirty yellow. Nodules may appear on the limbs and body, favourite sites being the face, back of the hands, external surface of the arms, wrists, thighs and groins. From time to time fresh crops of lepromatous nodules appear generally associated with a bout of fever which is known as lepra reaction or lepra fever.

Lepra Reaction (Anergic Reaction).—In the course of the disease, but only in the lepromatous type, occurs the well known lepra reaction or lepra fever. It is a condition caused by the breaking down of leprotic foci and the coincident multiplication of the acid fast bacilli. Lepra reaction usually occurs at some period or other of the disease and is an evidence of lowered resistance.

Signs and Symptoms of the Lepra Reaction.—Malaise, headache, general pains, always an evening rise of temperature with the fastigium between 3 and 5 p.m. The morning temperature is usually normal but fever may be remittent at onset. In addition there may be:

(1) The appearance of "rose spot nodules" or evanescent erythematous rashes which are especially seen in fair persons. These rose spot nodules vary from the size of a pea to lesions which may simulate erythema nodosum or the skin lesions of meningococcal septicæmia. The rose spot nodules are painful on pressure and are found in the extensor aspects of the back and limbs. They usually last twenty-four hours and come out in crops.

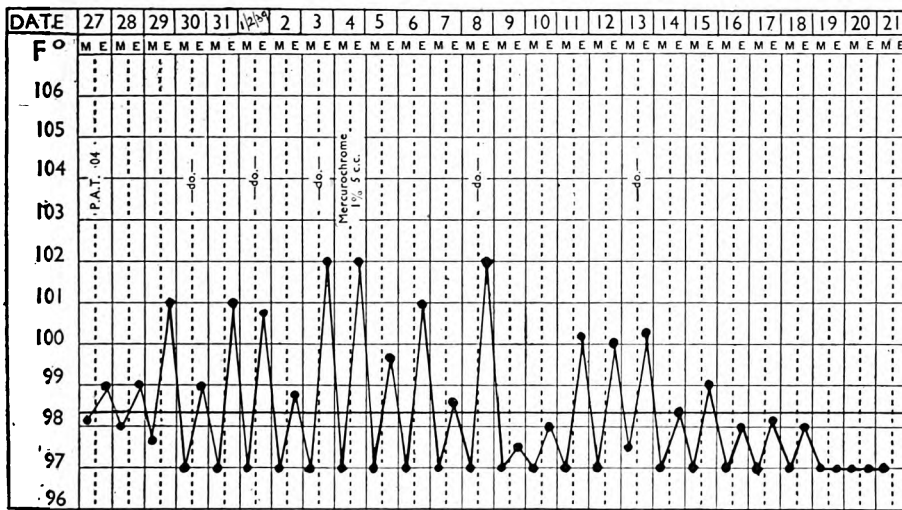
(2) Exacerbation of existing lesions or eruption of fresh lesions.

(3) Breaking down of and sometimes ulceration of existing lesions.

(4) The appearance of fresh subcutaneous nodules.

(5) Iritis, lymphadenitis and orchitis.

Lepra fever or anergic reaction may simulate undulant fever, malaria, pneumonia or any other febrile disease to which lepers can be liable. Ordinary clinical methods usually clear up any doubt in the diagnosis.



Acute lepra reaction. With acknowledgments to Cochrane.

Leprosy Nodules.—The normal and usual fate of a nodule is either first to soften in the centre and then be absorbed leaving a smooth circular patch of scar tissue or secondly, after softening, to ulcerate and discharge sticky yellow pus.

Neural Type.—In this type which is more resistant there is a well marked macular stage. Then follows severe neuralgic pain, formication, hyperæsthesia and anæsthesia. The lymphatic glands enlarge, there may be fever, the so called "allergic or recovery reaction," which is quite different from lepra reaction (see differential table).

There is definite evidence of nerve involvement with a loss of sensation followed by change in the skin, muscle and bone as the result of nerve

destruction. Superficial cutaneous nerves will be found to be enlarged, thickened and tender. Nerve abscesses may form.

Trophic ulcers may develop over exposed parts of feet and hands which may disorganize and penetrate.

DIFFERENTIAL TABLE OF ALLERGIC AND LEPRO REACTION (AFTER MUIR).

Allergic Reaction

In neural cases
May follow recovery from debility
Few bacilli present in the lesions
Giant cells, caseation and abscesses in nerves
Generally occurs once
Febrile and other systemic signs are usually absent

Anergic Reaction (Lepra fever)

In lepromatous cases
Occurs during debility
Many bacilli in the lesions
Lepra cells, abscess formation of cutaneous nodules
Tends to be repeated
Febrile and systemic signs well marked

Diagnosis of Leprosy.

At least one of the following three signs must be present before a diagnosis of leprosy is made.

(1) *Anæsthesia*.—In almost all cases of patchy anæsthesia the cause is leprosy. It is commonly found in the arms and legs in the distribution of the ulnar and peroneal nerves although other nerves may be affected. It is frequently found accompanied by anhydrosis, hypopigmented patches, keratosis and trophic ulcers.

(2) *Nerve Enlargement*.—In some cases of leprosy a thickened superficial nerve can be elicited quite easily by palpation. Pain and tenderness can be elicited by pressure. The commonest nerves affected are the ulnars; peroneals, greater auriculars and supra orbitals.

(3) Presence of lepra bacilli in the skin or nasal mucous membrane.

Skin Examination.—The best method of demonstrating lepra bacilli in the skin is by the "scraped incision" method of Wade (1935) the technique of which is as follows:

(1) Cleanse the area with a cotton wool swab soaked in alcohol soap and water, ether or petrol.

(2) Pinch the skin in a fold applying thorough compression to stop or minimize bleeding.

(3) Make the incision 5 mm. long by 2 mm. deep.

(4) Wipe away excess of blood or lymph.

(5) With the point of the knife scrape the side and bottom of the incision.

(6) Make a thick smear on a clean slide of the material obtained which should be actual tissue pulp.

(7) Patient is given a piece of cotton wool to compress the incision till oozing stops—no dressing is required.

Nasal Examination.—To demonstrate bacilli in the nasal mucous membrane, carefully examine with a nasal speculum and head mirror both nares for infiltrations, nodules and ulcers. If any of these is found, material should

be removed therefrom with a blunt narrow bladed scalpel by scraping deep enough to cause slight bleeding. Even when there is no visible lesion a scraping should be taken from the septum. The bacilli may be found on the septum, in the inferior and middle turbinates, or on the floor of the nose.

Mucus and other surface material should be wiped away before taking material for the smear.

Diagnosis of early lepromatous from early neural lesions (after Cochrane).

Early Lepromatous

- (1) The edges of the lesions are indefinite and difficult to see except in bright oblique light
- (2) There is no loss of sensibility
- (3) There is no enlargement of the subcutaneous nerves to the patches
- (4) There is no anæsthesia nor commencing atrophies in early cases
- (5) Lepra bacilli easy to find in skin or nasal mucous membrane
- (6) Leprolin test usually negative

Early Neural

- Edges of lesions definite
There is loss of sensibility to heat or touch
There is enlargement of the subcutaneous nerves to the patches
There is associated anæsthesia of the extremities and possibly commencing atrophies
Lepra bacilli difficult to find except in the allergic or reaction conditions
Leprolin test usually positive

Estimation of Resistance to Leprosy.

(1) *Leprolin (Mitsuda Test).*—This consists of the intradermal injection of 0.2 per cent of emulsion from an untreated lepromatous nodule. The emulsion is sterilized by heat and 0.05 per cent carbolic acid added (Muir's technique). Site of injection usually anteromedial aspect of the arm. A positive reaction consists of the appearance at the site of injection within one to three weeks of a wheal which reaches a maximum of 6 to 10 mm. in two to eight weeks.

Significance.—Leprolin test is always negative in lepromatous cases, always negative in children under 1 year, usually negative in children under 3 years, usually negative in persons affected without clinical signs, always positive in neural cases, always positive in healthy persons over 3, the reaction being proportional to age.

(2) *Sedimentation Rate.*—Has no specific significance in leprosy but has been found of great value in estimating the general resistance of leprosy patients.

Improvement takes place in those patients whose sedimentation rate is consistently low.

Almost all pathological conditions which cause an increased sedimentation rate also lower the resistance to leprosy.

Both of these tests are of great value in prognosis.

Differential Diagnosis.

The differential diagnosis of leprosy especially in the early stages bristles with difficulties and to give a list of all the diseases with which it may be confused and the diagnostic points would take a couple of hours. Many skin diseases and nervous diseases enter into the differential diagnosis.

The main diseases which may cause difficulty are :

- (1) Syphilis with its protean manifestations.
- (2) Leucoderma (vitiligo) or so called white leprosy.
- (3) Various forms of tinea.
- (4) Psoriasis.
- (5) Lupus.
- (6) Dermal leishmaniasis.
- (7) Ichthyosis.
- (8) Yaws.

In the later stages and especially in the *neural* form syringo-myelia and various nervous diseases which may cause trophic ulcers—claw hand and other acroteric lesions.

The lepromatous type may be, and often has been, mistaken for molluscum fibrosum or for von Recklinghausen's disease.

The absence of sensory changes and acid-fast bacilli in the lesions will clear the diagnosis in most cases.

General Treatment.

Leprosy is a chronic disease of long duration. Persons with leprosy suffer from concomitant diseases, both acute and chronic, besides the ordinary liability to parasitic infections of the intestines and skin.

Therefore any complicating conditions must be treated and eliminated as far as possible in order to raise the patient's resistance.

Leprosy may be a very slight disease, the infection proving abortive and the lesions healing up spontaneously without special treatment. This self-healing is largely dependent on a timely restoration or improvement of the general health of the patient.

Special Treatment.

The most commonly used preparations are :

(1) Hydnocarpus oil with 4 per cent. creosote given subcutaneously or intramuscularly.

(2) Ethyl esters of hydnocarpus given intradermally. Treatment should never be given in the acute stages when there is a great thickening of the tissues and enormous numbers of bacilli.

The best results are obtained in the early cases—late cases show no improvement.

Treatment of "Lepra Fever."—All specific treatment for leprosy should cease during lepra reaction. General fever treatment should be carried out with good nursing.

Special drugs which have been found useful are: Potassium antimony tartrate 0.04 gramme intravenously. Fouadin $\frac{1}{2}$ to 2 c.c. intramuscularly. Sulphonamide may be useful in treating swollen œdematous ulcerating limbs.

Prevention.—From the earliest times the belief has been that the segregation of infected persons from the community is essential to any method of prophylaxis.

In the past, too little stress was laid on the type which needed segregation and all cases were segregated indiscriminately.

Since 1931 the principle of selective segregation has been in force all over the world, i.e. the isolation of infective cases from contact with the healthy members of the community by voluntary or compulsory measures either in institutions or settlements.

Treatment, which ten years ago was considered to be the main weapon in the prophylaxis of leprosy, now takes a subsidiary place. Emphasis is laid entirely upon isolation.

The adage "Treat the early case and cure it, treat the infective case and render it non-infective" has not been found to be efficient in the control of leprosy, mainly because in many early cases the disease becomes spontaneously healed and in infective cases it takes such a long time to render a person non-infective that treatment alone is not an effective preventative measure.

It is now generally accepted that the only effective methods of control of leprosy are:

- (1) Segregation and treatment of infective cases.
- (2) Observation of closed cases and contacts of all cases whether open or closed.
- (3) Prevention of child leprosy.

Cochrane (1939) goes so far as to say that, if children could be prevented from being infected, leprosy would die out of the community because he does not think that adult infection alone could maintain the disease.

He considers the main effort in prophylaxis should be concentrated on the children.

Prognosis.

(1) *Contacts without Signs of Leprosy.*—If the contact was within the first few years of life and was prolonged and close with a highly infectious case then, even though several years have elapsed and no signs noticed, it is possible that generalized infection may have taken place which will show itself sooner or later.

In such cases the result of the leprolin test is most important—if positive the prognosis is good.

If the leprolin test in such cases is weak or negative the prognosis must be guarded.

In healthy adult contacts if a considerable period has passed and the leprolin test is positive the prognosis is better.

In debilitated adults with a weak positive or negative leprolin test and a high sedimentation rate the prognosis is poor.

(2) *Patients with Leprous Lesions.*—Neural type gives better prognosis than the lepromatous type always providing the patient remains in good health.

In lepromatous cases if the general health is good and sedimentation rate low a guarded prognosis may be given.

Leprosy Classification.—The International Congress on Leprosy which met at Cairo in 1938 decided on certain important alterations in the existing classification of leprosy.

(1) The term cutaneous for the malignant form was dropped and the term lepromatous substituted, with the symbol L.

(2) The neural type of leprosy was subclassified into: Anæsthesia (Na); simple macular (Ns); tuberculoid macular (major and minor) (Nt).

(3) *Mixed Cases.*—Recognition was no longer given to “mixed leprosy” as a type. However, as cases of lepromatous type usually exhibit sooner or later varying degrees of polyneuritic involvement and, for precision, such “mixed” or “complete” cases may be designated L N. The symbol L should be given precedence regardless of the original nature of the case. In grading the degree of advancement the appropriate figure is placed after each symbol, e.g. L2 N1 or L1 N3.

“Mixed cases” in which the lepromatous lesions have resolved leaving only the polyneuritic manifestations were to be called secondary neural.

(4) Varieties of the lepromatous type were not considered sufficiently established to justify special subclassification.

NOTES ON THREE CASES OF LEPROSY AMONGST MALTESE TROOPS.

Case S. V.—Service 2 years, enlisted in 1937 in Territorials K.O.M.R. Brother had leprosy—was under observation by the Leprosy Board as a contact (this was not disclosed to the military authorities by the patient). Patient comes from Mgarr Village.

In March, 1939, was declared infective and ordered into the Leprosy Hospital. He immediately disappeared and tried to join the R.M.A. Regular Army. This was discovered after fifteen days and he was immediately admitted to St. Bartholomew's Hospital on April 11, 1939.

On examination he presented a very slight erythema and infiltration of forehead, cheeks and chin. The lobules of both ears were also slightly thickened. The mucosa of the nostrils was hyperæmic and showed a small ulcer on the middle turbinate of the left side. Slit smears from ear lobules and nasal smears showed a small number of *Mycobacterium lepra*. No anæsthesia was present. Classified L1.

He remained in the Leprosy Hospital till October 1940 when he was discharged non-infective.

Case A. M.—Aged 23, service 18 months. A motor driver in the Malta Auxiliary Corps. One brother had leprosy and died in St. Bartholomew's Hospital. Patient comes from Mellieha Village.

First noticed a small nodule over left eyebrow four months previously but did not bother about it or report sick.

On being called up for conscription on July 5, 1941, and while still in Malta Auxiliary Corps he was found to have:

(1) Congestion and hyperæmia of inferior turbinate with a shallow ulcer on septum in which *B. lepræ* were found.

(2) Well marked typical leprous nodule at outer end of L supraorbital ridge in which *B. lepræ* were found.

(3) Erythematous macular rash over chest with patches of normal skin over sternum. Rash extended over abdomen.

(4) Two erythematous macules slightly raised on the back of upper arm and forearm.

(5) Anæsthesia to light touch over back of forearm also on backs and fronts of legs.

(6) Trophic ulcer over right ankle.

He was admitted to St. Bartholomew's Hospital on August 7, 1941, and is still a patient there. Classified L2 N2. This case was shown at the meeting.

Case G. S.—Gunner R.M.A., aged 29, service 2 years. From village of Qurmi—no family history of leprosy and no known contact.

About six months ago noticed small spots on face and forearm which gradually increased in size—some of these ulcerated—the eruption was gradual, nodules appearing on his face, arms and legs.

He reported sick several times and was variously diagnosed secondary syphilis, von Recklinghausen's disease and infected mosquito bites.

He was finally diagnosed leprosy and admitted to No. 90 General Hospital on July 5, 1941, where he was boarded and transferred to the Leprosy Hospital on July 7, 1941.

The clinical condition was then as follows:

Multiple subcutaneous nodules on forehead, chin, head, pinnæ, face and trunk; large erythematous plaques on extensor aspect of arms and legs. Thickening of the skin on the face. There was no anæsthesia. There was a small ulcer from a breaking down nodule on right leg from which lepra bacilli was obtained.

The nasal mucosa was congested and a scraping also revealed lepra bacilli. Classified L1.

There was no history of fever or syphilis but Wassermann reaction and Kahn were both positive.

This patient was shown at the meeting. His classification then was L1 N1 as definite anæsthesia had developed.

ACKNOWLEDGMENTS.

To Professor A. V. Bernard, C.B.E., M.D., D.P.H., D.T.M. & H., Chief Government Medical Officer, for his permission to publish the notes on these cases which had passed out of military control at the time of my examination of them, also for his assistance in the loan of literature on the subject of leprosy in Malta.

To Dr. A. C. Briffa, M.D., D.P.H., Leprosy Control Officer, Malta, for permission to use his notes on the original condition of two of the cases reported.

To Lieutenant-Colonel J. A. Davidson, R.A.M.C., for his help and criticism.

Other acknowledgments have been made in the text.

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LEPROSY CLASSIFICATION (AFTER COCHRANE).

LEPROMATOUS (L) TYPE	<i>Malignant or non-resistant leprosy. Essential cell — "the lepra cell"</i>
<i>Symbol L</i>	L1, L2, L3 indicating early, moderately advanced, and very advanced cases respectively
<i>Clinical Signs</i>	Hypopigmentation, erythema, infiltration, nodulation
<i>Histologically</i>	No focalization of the granuloma, lepra cells present, no epithelioid or giant cells. Nerves in the cutis stand out and do not appear to be invaded
<i>Leprolin Test</i>	Always negative
<i>Acid-Fast Bacilli</i>	Always found in lepromatous cases in large numbers
<i>Infectivity</i>	High
<i>Prognosis</i>	Poor
NEURAL (N) TYPE	<i>Benign, or resistant leprosy. Essential cell—epithelioid and giant cell</i>
<i>Symbol N</i>	N1, N2, N3 indicating early, moderately advanced, and very advanced cases respectively
<i>Subdivisions</i>	Anæsthetic (non-macular, polyneuritic) (Na) Simple neural (with flat macules) (Ns) Neural tuberculoid (minor and major) (Nt)
<i>Clinical Signs</i>	<i>Anæsthetic.</i> Anæsthesia, anhidrosis, paralysis or paresis, trophic lesions <i>Simple neural.</i> Hypopigmentation, anæsthesia, nerve enlargement (larger nerves). <i>Neural tuberculoid.</i> (Hypopigmentation, raised erythematous infiltrated lesions, anæsthesia, enlargement of cutaneous nerves)
<i>Histologically</i>	Signs of nerve invasion, focalization of the granuloma, epithelioid and giant cells present
<i>Leprolin Test</i>	Always positive
<i>Acid-Fast Bacilli</i>	Usually absent but may be found in the neural tuberculoid, especially during allergic reaction
<i>Infectivity</i>	Low
<i>Prognosis</i>	Good as regards life but mutilation may take place

A NOTE ON THE DIAGNOSIS AND TREATMENT OF CHRONIC RHEUMATIC DISEASES IN SOLDIERS.

BY COLONEL R. G. GORDON,

AND

MAJOR G. D. KERSLEY,

Royal Army Medical Corps.

THERE is no doubt that chronic rheumatic diseases present a serious problem in military medicine just as they do in civil practice.

In the first place, medical officers often find that they have difficulty in deciding on the exact diagnosis, on the significance of symptoms and on the proper treatment and disposal of their patients.

In the second place, aches and pains are vague symptoms which are easily simulated and exaggerated and the serious view which may quite rightly be taken of certain patients complaining of such symptoms encourages others less robust in their attitude towards their military duties to hope that, if their complaints are loud enough, an equally serious view will be taken in their own case.

In the third place, treatment is prolonged and unless persistently and consistently carried out is likely to be disappointing. This leads to prolonged hospitalization of patients with considerable detriment to their morale, whether their future is in the Service or in civil life, and causes unnecessary expenditure of public funds.

It is of course impossible to cover the whole field of "rheumatism," its diagnosis and treatment in an annotation such as this but an attempt has been made to summarize the main points in as few words as possible. In order to do this it has been necessary to be somewhat dogmatic and quote principles that will apply to the majority but not all cases. Moreover, the suggestions on length and type of treatment and disposal of cases apply to the Services at war and some may not be applicable in peace time whether in civil life or not.

ARTHRITIS.

Rheumatoid Arthritis.

This condition is uncommon in the Army but will no doubt be met with occasionally in young soldiers.

Diagnosis.—The points to be noted in early diagnosis are:

- (1) Symmetrical swelling; pain and tenderness especially of small joints, phalangeal and metacarpo-phalangeal, wrist and knee.
- (2) Considerable constitutional disturbance sometimes with mild pyrexia.
- (3) Marked increase in sedimentation rate.

(4) Blood changes if present are anæmia and an Arneth shift to left.

(5) Osteoporosis and muscular wasting in general (X-ray of hand is the best indication of this).

Treatment.—This must be in hospital. Rest, feeding and fresh air are main considerations in early weeks. Specific treatment, including gold and removal of any foci of infection discovered, should only be undertaken on the advice of a physician experienced in the treatment of rheumatic diseases. In the majority of cases where gold is indicated the patient should not be retained in the Service. General progress will best be indicated by the sedimentation rate. Only very conservative hydrotherapy or physiotherapy are indicated in the early stages. Correct orthopædic positions of joints must be maintained, if necessary by plaster.

Disposal.—As this is a prolonged progressive disease, with early improvement only too often a temporary remission, these patients should be submitted for Board, with a recommendation for invaliding from the Army, directly the diagnosis is certain and the patient is reasonably fit to leave hospital.

In order to ensure continued treatment if invalided from the Army efforts should be made to supply information to the patient's civilian doctor.

Toxic Arthritis.

This condition which will tend to occur in the older soldier may simulate rheumatoid arthritis very closely but is associated with a definite focus of infection.

Diagnosis.—(1) Swelling, pain and tenderness in any joint not necessarily symmetrical.

(2) Constitutional disturbance as a rule is not marked and pyrexia uncommon. When sepsis is severe however constitutional disturbance may be considerable.

(3) Sedimentation rate may be increased or normal.

(4) There may be leucocytosis; otherwise blood picture is generally normal.

(5) Osteoporosis and muscular wasting if present are confined to the region of the infected joint.

Treatment.—(1) Removal of septic focus. Care must be taken if general condition is poor, e.g. teeth removed one at a time.

(2) Rest and counter-irritation of affected joints. When swelling, pain and tenderness have subsided physiotherapy will be required to restore muscular function and mobility of joints.

Hydrotherapy may be very useful for this purpose but in the Service it is not justifiable to continue this treatment in a special hospital for more than three weeks.

Disposal.—After three weeks general treatment and physiotherapy or hydrotherapy at a special hospital the patient should not need to be invalided from the Army but he will probably have to be regraded owing to liability of previously infected joints to flare up under serious strain.

Some may be fit for immediate return to units but most should be sent to convalescent depot for hardening and testing as to capacity.

Gonorrhœal Arthritis.

This condition is difficult to diagnose and is probably less uncommon than is generally supposed.

The main point is the establishment of a history of gonorrhœa which may be difficult since arthritis often follows very mild attacks. Where suspected, prostatic massage with careful pathological examination of expressed material should be practised. Since concealment of venereal disease is a crime in the Army, in the absence of history of infection and treatment care should be taken in recording a diagnosis of gonorrhœal arthritis and probably in all such cases the diagnosis should have a ? attached since recent infection cannot be proved and diagnosis is only inferential however probable.

Diagnosis.—(1) After a polyarticular migratory phase the condition is often localized to one joint, the commonest being knee, carpus, tarsus and sternoclavicular. The joint is red, very tender and swollen.

(2) General constitutional disturbance is uncommon and pyrexia may be present.

(3) Tenosynovitis is frequently present.

(4) No marked osteoporosis.

(5) Gout should be remembered in differential diagnosis.

Treatment.—Hyperpyrexia is much the most promising treatment.

Disposal.—Although treatment may be fairly prolonged most patients should eventually be fit for return to unit or regrading to lower category.

Other Forms of Infective Arthritis.

It should be remembered that arthritis may be met with in association with scarlet fever, dysentery, typhoid, purpura and hæmophilia, but these forms do not require treatment other than that of the accompanying disease, except in the later stages when physiotherapy and/or hydrotherapy may be useful under the same conditions as are referred to under Toxic Arthritis.

Osteoarthritis.

True disabling osteoarthritis must be very rare indeed within the age limits of military service except after severe injury. Mild and even moderate lipping of vertebral margins and ossification of muscle and tendon attachments are not responsible for osteoarthritic pain and should never be diagnosed as osteoarthritis. Any disability present, where such is shown

in X-ray photographs, is due to fibrositis and should be diagnosed and treated as such.

Osteoarthritis if present and producing pain is a degenerative progressive condition characterized by local areas of osteoporosis with compensatory hypertrophy and thickening of bone. Cartilage may be denuded with consequent narrowing of joint interval but there is no true ankylosis. The hip-joint is much the commonest site of this disease.

When the diagnosis is definitely established such patients should be submitted to a Medical Board with a recommendation for invaliding from the Army. Since there is no danger to life and treatment is very prolonged this should not be undertaken in military hospitals.

Fibrositis.

This is the commonest chronic rheumatic disease in the Army and is difficult because, unless the medical officer has had considerable experience of the condition and has taken the trouble to study the objective indications, the criteria appear to be wholly subjective and therefore doubt may be felt as to when a patient is genuine, when he exaggerates symptoms or even deliberately malingers. That much Service time is unnecessarily lost by soldiers labelled with this disability is unquestionable.

Diagnosis.—(1) The patient complains of pain, stiffness and tenderness in certain places.

(2) If the patient is placed in such a position that the muscle involved is fully relaxed and the tender spots can be palpated against subjacent bone hard fibrous nodules and bands can often be felt. Nodules can be found which are not tender and these indicate previous attacks of fibrositis but are not significant for the present attack. The constancy of the location of the tender spot on successive examinations is significant of genuine disability.

Pain is not always localized at the tender nodule since it may be "referred" in accordance with the distribution described by Lewis and Kellgren (*British Medical Journal* 1938, 1, 324).

It is often possible to elicit pain by stretching the muscle either by active or passive movement so as to pull upon the tender nodule. Constancy of this finding is significant of a genuine disability.

(3) Subcutaneous tissue, intramuscular trabeculae, fascia, tendon junctions to muscle or bone, periarticular and perineural tissue may all be involved in the fibrositic process.

(4) There is no appreciable disturbance of general health except after very prolonged pain, no pyrexia, no change in blood count or sedimentation rate.

(5) There is no bony change or abnormal X-ray appearance though bony lipping may suggest a condition of muscular strain favourable to fibrositic development.

Treatment.—(1) The acute pain may be dramatically relieved by injection

of local anæsthetic (Novutox) into the tender spot. Failure to achieve even temporary relief if care is taken to inject in the right fascial layer and into the true origin of the pain (Kellgren's spots) makes it unlikely that the diagnosis of fibrositis is correct and, if no other cause of pain be discovered, e.g. referred pain from visceral disease, herpes zoster, etc., then the genuine nature of the patient's subjective complaint should be suspect.

Sometimes this treatment suffices to clear up the attack which may not recur for months or years.

(2) More commonly, although the acute pain is removed, aching and stiffness persist. In such cases physiotherapy (massage and heat) or spa treatment if skilfully carried out and for a restricted time does a great deal of good.

When the acute stage is past patients should be examined and a careful note made of the location of pain and tenderness and range of movement if any given movement is restricted.

He may then be sent to a specialist hospital for rheumatic diseases with strict instructions that he be returned to the Military Hospital after a period of not more than three weeks.

A further examination should then be made comparing the condition with the notes of the previous examination.

Disposal.—If the medical officer is satisfied that only slight improvement has ensued and that the disability is really genuine the patient should be referred to a Medical Board with a recommendation for regrading. This should only be necessary in a small number of cases and that in elderly soldiers.

Otherwise the patient should be returned to his unit and further complaints of pain and stiffness strictly discouraged.

Cases of fibrositis do not seem to do well at the Convalescent Depot and are better returned to the unit.

N.B.—Most "Anterior Crural Neuritis," "Brachial Neuritis," "Pleurodynia," "Intercostal Neuritis," are examples of fibrositis in the neighbourhood of a nerve but these may require more conservative treatment.

Sciatica.

True sciatica is an uncommon but serious condition. Milder forms chiefly depend on fibrositis of the intragluteal fascia and the fascia over the sacroiliac joints and should be treated as such. Extra care is however needed in choosing the stage at which massage, etc., should be applied. In the latter cases manipulation may be very useful if followed by adequate after-treatment. It should be remembered that sciatic pain may be due to reference from disease of the rectum, prostate or other pelvic organs. Sciatica due to prolapsed nucleus pulposus and sacralization (formation of false fibrous joint) of the 5th lumbar transverse process does occur but is in the nature of a medical curiosity.

Diagnosis.—(1) Acute pain referred in the course of the great sciatic nerve.

(2) Tenderness over the sciatic notch, below the gluteal fold, over the neck of the fibula.

(3) Pain on flexing the extended leg on the trunk.

(4) Diminution or loss of the ankle-jerk.

(5) In severe cases objective anæsthesia and muscular wasting occur.

Treatment.—The initial treatment of all cases of true sciatica should be rest in bed with or without a back splint or plaster until severe subjective pain has disappeared for a week.

Treatment by gentle massage should then be recommended and if tolerated the patient may be sent to a hospital specializing in the treatment of rheumatic diseases for three weeks.

Disposal.—Careful note should be made of location and degree of tenderness, of the average angle to which the extended leg can be flexed on the trunk without eliciting pain on three separate occasions and the state of the ankle-jerks before and after the spa treatment. If definite improvement has taken place further treatment either at a spa hospital or by physiotherapy elsewhere may be advised. A severe attack of sciatica usually takes at least three months to recover. In any case the patient should be referred to a Board with recommendation for regrading.

If no appreciable improvement has taken place on the second examination the patient should be recommended for invaliding from the Army since he will neither be able to stand the strain of marching nor standing nor of sitting except on a special chair.

Gout.

Though not common amongst soldiers this condition is sometimes missed.

Diagnosis.—Gout should only be diagnosed if at least two of four criteria are present.

(1) A localized red shiny exquisitely painful swelling in the region of a joint. The joint affected will be one subject to strain or minor trauma hence the common seat of election in the 1st metatarso-phalangeal joint.

(2) An increase in the blood uric acid. In early cases the absence of this even on the first days of the attack does not exclude gout but a positive finding is quite conclusive.

(3) A raised sedimentation rate.

(4) The presence of tophaceous deposits in bone, cartilage, bursa or sometimes in subcutaneous tissues. X-ray appearances if present are almost pathognomonic with punched out areas in the neighbourhood of joints, though similar small lesions are occasionally found in cases of rheumatoid arthritis.

Treatment.—(1) In the acute stages 10 to 30 minims of vin. colchici with

alkali should be given four-hourly till severe pain has subsided. Aspirin is a useful adjuvant.

(2) Rest to the joint with mild counter-irritation as the inflammation subsides.

(3) Hydrotherapy, especially vapour baths, and plenty of mineral water to drink for three weeks only.

(4) Light diet with plenty of fluids and a minimum of fats and purins. The bowels should always be kept well open.

(5) If blood uric acid is still increased after the attack subsides Atophan up to 10 grains t.d.s. for four days each week for six weeks according to level of blood uric acid increase may be indicated on specialist's advice. It should be remembered however that Atophan is a dangerous drug and a safe and reasonably effective alternative is salicylate in 30-grain doses t.d.s. with alkali.

Disposal.—In any case the patient should be referred to a Board with recommendation for regrading, after recovery of early attacks, since undue strain will almost certainly cause a flare up. If several attacks have already occurred the patient should be recommended for discharge from the Army.

N.B.—Gout is almost always associated with fibrositis which will require treatment. Chronic gout if recurrent in the same joint will usually lead to osteoarthritic changes in that joint.

INTESTINAL OBSTRUCTION BY AMŒBIC GRANULOMATA.

BY CAPTAIN J. A. M. CAMERON,

Indian Medical Service,

AND

MAJOR J. C. COLLINS,

Royal Army Medical Corps.

IN considering the ætiology of obstructive tumours of the large bowel the "Big Three" immediately spring to mind; but besides cancer, tubercle, and syphilis the tropical surgeon may well murmur "The Big Four" and include amœbiasis under this head.

Since an hypertrophic type of amœbic disease is not common in the intestine itself, it is not usually thought of in making a differential diagnosis in the case of large bowel tumours; but now that isolated cases are being reported in the literature the scant mention of such a condition in the text-books will no doubt be amended.

CASE REPORT.

Corporal E. B., aged 27, was admitted as an acute abdominal emergency; severe pains across the navel area had been present for forty-eight hours, much worse in the twenty-four hours preceding admission, and were associated with vomiting. One profuse vomit twenty hours before we saw him had produced considerable relief. Bowels had not moved for three days.

In the patient's own words, there was "a feeling of weight between the bladder and rectum for three weeks, with some bowel irregularity, and the occasional passage of blood and slime." No urinary symptoms and no history of dyspepsia.

Pulse and temperature were normal but the respiratory rate was 30 per minute due to crampy abdominal pains. The patient, although well-nourished, was dehydrated; the tongue foul and covered with a brown coating. A tumid abdomen, not rigid, contained no palpable masses, but half-way between the navel and the right subcostal line really acute tenderness was elicited. Auscultation revealed windy peristaltic sounds.

By rectum: One inch above the anus a slightly tender annular swelling, incorporated in the rectal wall, and above this again a firm but not hard mass in the recto-vesical pouch caused us to write "this mass feels decidedly inflammatory."

An enema produced a few fæcal lumps, but most of it was retained. Immediate examination showed no exudate and no protozoa. Urine was normal. White cells 20,000 per c.mm.

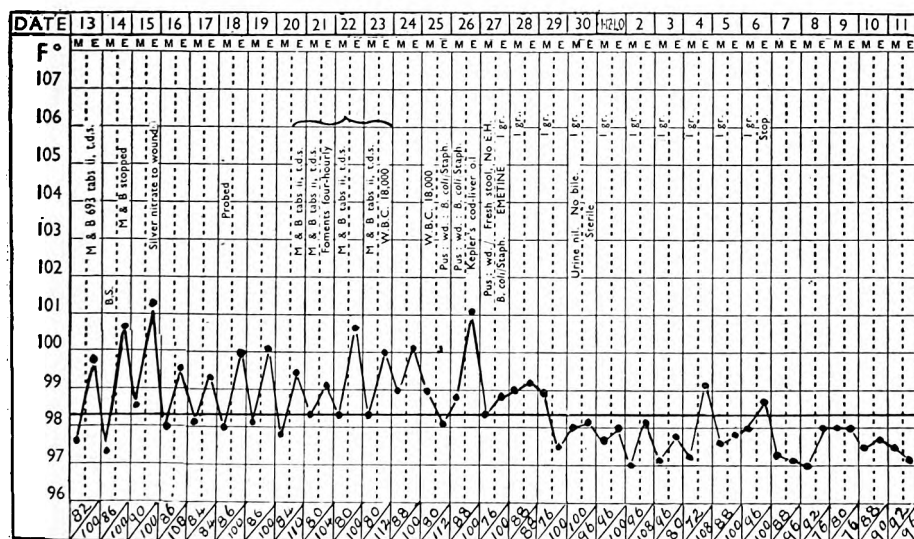
The observation period lasted thirty-six hours, during which pulse and temperature remained normal and there was no vomiting. However, the increasingly windy pains and a spreading area of epigastric tenderness, together with a foul tongue, constipation, and an anxious expression, led to laparotomy for intestinal obstruction.

Operation.—An excellent anæsthetic was obtained with spinal and twi-

light sleep (16 c.c. of 1 : 1500 Percaine, with patient sitting for thirty seconds).

An exploratory entry by a short upper right paramedian incision revealed abundant clear free fluid and two masses. One was the size of a normal non-gravid uterus and occupied the rectal ampulla. No adhesions were there; a chain of soft glands ran up the hollow of the sacrum. The larger mass, the size of a tennis ball, occupied the full circumference of the transverse colon. It lay to the right of the mid-line and corresponded to the area of acute tenderness on clinical examination. It was red and angry-looking, and on raising the greater omentum lymph exudate was present on the posterior surface of the mass, which was freely mobile. There were no peritoneal implants, and the swelling was too soft for a carcinoma. More than any other lesion, it resembled Crohn's disease in its acute inflammatory phase.

The whole large bowel was thickened and injected and, proximal to the mass in the transverse colon, it was distended. Resection of this larger tumour was quite feasible, but there still remained the smaller one obstruct-



ing the rectum. Therefore we closed the exploratory wound and established a cæcostomy, by withdrawing a pouch of cæcum, suturing it to the peritoneal edge, and wrapping the fundus in vaseline gauze for thirty-six hours. A curved pair of Kocher forceps retained this cæcal pouch in position. Intravenous drip saline was given post-operatively.

On the second day the cæcum was opened under intravenous sodium pentothal (8 c.c.). After profuse foul evacuation a catheter was pushed into the ascending colon and drip saline given. This went on for four days and was, in our opinion, responsible for tiding the patient over the most critical period of his illness.

Post-operative Course.—During the next month the patient lost weight steadily (170 down to 120 pounds) and ran an intermittent fever which was only temporarily benefited by three five-day courses of sulphapyridine. Investigations which were carried out are as follows: W.B.C., always above

14,000 with a polynuclear leucocytosis. Blood Wassermann and Kahn negative. Blood culture and agglutination against typhoid, paratyphoid, melitensis and abortus groups were negative. Repeated stool examinations were negative for ova, parasites and cysts. Culture gave *B. coli* only. Urine was repeatedly found normal and sterile.

The diet was high-calorie and non-residue in nature, and bulk made up with Isogel. Washouts through the cæcostomy were unavailing.

Only when the skin about the cæcostomy became a fungating mass was it realized that the pathological process affecting the underlying bowel had spread to the parietes. The pus from this stoma yielded polymorphs and *B. coli* only. Sigmoidoscopy showed a narrow rectum, with no ulcers, and the instrument was passed for 4 inches only; however, there was an evident nodular condition deep to the mucosa, while foul mucus lay in the rectum.

Emetine was given empirically, with dramatic effect.

After 3 grains had been given the temperature came down and remained down; 12 grains of emetine hydrochloride were given in twelve days followed by 0.25 gramme of carbarsone b.d. for a month, with the exception of week-ends. The cæcostomy rapidly became clean, then stopped discharging fæces, and finally closed and healed soundly within a month of starting emetine. Thereafter the patient rapidly gained weight and strength. Rectal examinations revealed progressive subsidence in the periproctitis. A barium enema six weeks after discharge from hospital showed no abnormality. The patient is now a fit fighting man.

SUMMARY.

- (1) An obstructive granulomatous tumour of the large bowel may be amœbic in origin, and may occur at two different sites.
- (2) In this case skin involvement first suggested the correct diagnosis.
- (3) Emetine may be a most valuable diagnostic drug.

ACKNOWLEDGMENTS.

The Staff, B.M.H., Karachi.

The Bde. Lab., Karachi.

We wish to thank Colonel A. F. C. Martyn, Officer Commanding, British Military Hospital, Karachi, for kind permission to send this case for publication.

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Editorial.

IMMUNIZATION AGAINST TYPHUS.

LAST winter the threat of typhus assumed serious proportions in Western Europe. Germany in particular was in danger from her eastern borders and energetic preventive measures were taken in the Reich and occupied countries. Because of these precautions, or for other reasons, the disease remained under control; and though there were outbreaks in Spain as well as in Poland and the Baltic States, the alarming prospect of a pandemic did not materialize. Circumstances were not as yet sufficiently favourable to the infection.

Control of exanthematic typhus by destruction of lice is feasible so long as the public health organization is working efficiently. The working of such organization depends largely, however, on the continuance of normal conditions. In modern warfare the whole territories of the belligerents are exposed to enemy action and at any moment it may become impossible to maintain arrangements for disinfestation and bathing. Since hygiene may be an inadequate safeguard against typhus a satisfactory means of immunizing large populations against this dreadful scourge would be one of the greatest benefits medical science could offer. Though complete success in this direction has not yet been achieved the latest immunizing agents are certainly a big advance on the original vaccines and intensive studies in progress here and in the United States and the Dominions promise further improvement.

In 1915 inoculation was practised in the Turkish Army, using typhus patients' blood, defibrinated and heated for an hour to 60° C., but the reported results were not convincing. Later Nicolle recommended small injections of diluted virulent typhus blood or guinea-pig typhus serum. Undoubtedly these were sometimes efficacious, but even with small quantities there were many unfortunate sequels and it was clearly impossible to be sure of the actual dose. There are also obvious dangers in the use of any living vaccine to protect people against a disease spread by lice. But, as it was generally felt that killed vaccine was valueless, a variety of other living-tissue vaccines were successively introduced.

The situation changed when rickettsiæ were shown to be responsible for typhus and it became practicable to make more or less pure suspensions of the causal organism. The first of the new vaccines was prepared by Weigl in Poland from the guts of lice fed on typhus-immune hosts and inoculated with rickettsiæ per rectum. After a suitable interval the guts, now teeming with rickettsiæ, were dissected out and ground up and when the tissue cells had been removed by centrifugalization the supernatant fluid was phenolized

and constituted the vaccine. Four or five injections have to be given and the yield of vaccine is so small that 300 to 400 lice may be needed for immunizing a single individual. The preparation of this vaccine is thus extremely laborious and requires a large and expert staff, which means that it has to be reserved for key personnel. Nevertheless large numbers have been inoculated with Weigl's vaccine and, though the protection it confers is only partial, it has until recently been regarded—at any rate on the Continent—as the only effective immunizing agent.

On the ground that murine (endemic) typhus and exanthematic (epidemic) typhus are antigenically related, and that cross-immunity is probable, the French workers produced various types of vaccines from suspensions of murine rickettsiæ and used them widely but there was little true statistical evidence in their favour. Efforts have since been directed towards discovering methods whereby rich suspensions of epidemic typhus rickettsiæ can be readily prepared and three main procedures have been devised: (a) the agar-slant tissue-culture method of Zinsser; (b) the yolk-sac method of Cox; and (c) the mouse-lung method of Durand and Giroud. Vaccines made in any of these ways will protect animals against experimental infections and, though their usefulness has not yet been proved by field trials on a large scale, critical examination of the yolk-sac vaccine (including certain modifications) and the mouse-lung vaccine suggests that the newer yolk-sac vaccine is the best available to-day. Its production in large quantities is now in hand.

Laboratory infections with typhus are very easily acquired and few workers with rickettsiæ escape unless they are already protected by an attack of the natural disease. Such infections, moreover, are apt to be severe because of long exposure and big infecting doses. In two laboratories in this country now investigating rickettsiæ the staffs have been immunized by three primary doses of egg-yolk vaccine followed by a reinoculation dose three-monthly and, though they have all contracted the disease, the illness of all but one has been remarkably mild. Indeed, in two cases the disability was so slight that they were not off duty and their condition would have been overlooked had it not been expected.

Complete protection against exanthematic typhus by mass inoculation may not yet be an accomplished fact. But the great reduction in the gravity of the symptoms in inoculated persons justifies extensive use of the latest vaccine.



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Royal Army Medical Corps,

AND

REGIMENTAL SERJEANT-MAJOR J. A. HOGARTH,

Royal Army Medical Corps.

THE evacuation of stretcher cases from a cliff head to the beach below, as for example after a beach landing, presents many difficulties. An apparatus has been devised in this unit which enables stretcher cases to be lowered rapidly and with maximum comfort to the patients.

The following materials are necessary for the apparatus:

- (1) A pair of sheers (9 feet high).
- (2) Ropes and pickets to hold the sheers in position.
- (3) Two pulleys.
- (4) $1\frac{1}{2}$ -inch manila rope for haulage.
- (5) Guiding rope.
- (6) Improvised boat hook.
- (7) Sling for stretcher.

The "sheers" consist of two pieces of pine wood, each 9 feet long, joined by an iron bolt about 12 inches from the top.

The sling is constructed in the following fashion. A large metal ring of about 4 inches diameter has a smaller ring of about 1 inch diameter welded at a point on its circumference in such a manner that the small ring is at right angle to the large ring. In other words the rings, if viewed laterally, form the shape L. To the large ring are spliced four lengths of rope, two on either side of the small ring, each end having a loop at the end large enough to pass over the handle of a stretcher. The overall length of each piece of rope is 4 feet.

The apparatus is erected as follows:

A squad of four men, carrying with them the guiding rope, climb to the top of the cliff. They select a point on the cliff edge where there is, if possible, a straight drop below with no projecting rocks and where there is a fairly level piece of ground on top.

The squad throw over one end of the guiding rope and by means of this rope they raise to the top of the cliff a mallet, pickets, pulleys, boat hook and the end of the haulage rope which is threaded through the pulleys.

A picket is driven in and one of the pulleys hooked on to it. The other

pulley is lowered to the beach, the sheers attached and then hoisted to the cliff top.

The sheer legs are opened so that the butt ends are about 6 feet apart and resting at the cliff edge. A small cavity is chipped out of the edge opposite each butt. Two stay ropes are attached to the X of the sheers and the upper of the two pulleys hooked on. To the lower pulley is hooked the large ring of the sling.



FIG. 1.—Clearing the cliff edge.

The guiding rope is passed through the small ring of the sling and attached to the top of the sheers.

The sheers are now ready for erection. They are raised to the perpendicular position, care being taken that the butts are resting in the cavities prepared for them. The top of the sheers is pushed outwards so that when the sheers are erected the equipment necessary at the cliff top may be hauled perpendicular. They are maintained in this position by tying off the two stay ropes to pickets situated 15 to 20 feet behind the sheers. Once the

sheers are erected the equipment necessary at the cliff top may be hauled up, e.g. stretchers, blankets, dressings.

The apparatus can be operated by two squads of four men, one squad on the cliff top and one on the beach. The squad on the beach divides in two, one pair manning the hauling rope and the other pair manning the guiding rope. The squad on the cliff is responsible for loading or unloading stretchers from the apparatus at the top.



FIG. 2.—The stretcher descending.

In order to lower a stretcher case down the face of the cliff the slings are pulled in between the legs of the sheers by means of the boat hook. The four loops of the sling are slipped on, one over each handle of the stretcher. The stretcher is carried by hand to the edge of the cliff and hauled up as far as possible by the pulleys. The stretcher swings out from the cliff and is steadied by the boat hook. It is then lowered gently and without jerks to the beach, the smaller ring of the sling sliding down the guiding rope which is held taut from below.

Using this method there is no danger of the stretcher knocking against the cliff face nor does the stretcher gyrate.

Conversely, the stretcher can be raised from the beach to the cliff top.

It is advisable, but not essential, that the patient be secured to the stretcher by universal sheets or other means.

The weight of the apparatus is small. It can be carried easily by four men.

We are indebted to Colonel S. D. Reid for permission to submit this paper for publication.

NOTES ON SOME COMMON DISORDERS OF THE EAR, NOSE AND THROAT.

BY MAJOR R. R. SIMPSON,

Royal Army Medical Corps.

It is hoped that in these notes medical officers in Field units will find some help in the treatment of ear, nose and throat cases as they are met with on active service. No pretence is made at any adequate discussion of the problems. All that is attempted is to give some guidance on the type of case for which treatment can be tried in the Field and as to which cases should be evacuated to the Ear, Nose and Throat Specialist. The points discussed were found to be the common problems in France and the means of treatment suggested can be supplied by the Field or Regimental Panniers. If some of these patients can be kept in the line while treatment is being given much valuable time and expense will be saved.

Wax.—Wax in the ear is either soft and easily syringed out or it is hard and often presents difficulties. If it appears to be very hard no attempt should be made at syringing when first seen. It is wiser and easier to soften it for a day or so before syringing is tried. It may be softened by instilling one of the following: a 2 per cent solution of sodium bicarbonate, glycerin boracis or glycerin itself, or liquid paraffin. The drops should be put into the ear with the head bent over so that the affected ear is uppermost and the head should remain in this position for two to three minutes. This should be repeated at least three times in the twenty-four hours before syringing. With the wax softened, an ordinary Higginson syringe can be used to clean out the meatus. Water or a solution of sodium bicarbonate may be used for this purpose but whatever solution is used it should be at blood temperature in order to avoid the uncomfortable giddiness set up by any cold solution in the ear.

If the syringing fails to remove the wax, you are probably dealing with a condition known as "keratosis obturans." This type of case is best dealt with by a specialist as it may require an anæsthetic before the wax and the desquamated epithelial cast (which is the explanation of the difficulty in removal) can be successfully coaxed out of the meatus.

Dermatitis of the Meatus.—Of the many ointments and treatments recommended in these cases few, if any, will be available in the Field. But in the milder cases there is no necessity to put a man off duty nor to send him to the specialist. These cases run a comparatively short course as a rule and any emollient will generally suffice provided certain precautions are taken. When first seen the ear and meatus should be cleaned out as thoroughly as possible with a mild antiseptic solution and an ointment or liquid paraffin or castor oil generously spread over the affected area. No cotton-wool is necessary; indeed by sticking to the surface it is harmful. No washing of the ears should be allowed as water irritates these cases very much. Hydrogen peroxide should never be used as in itself it is irritating to the skin and spirit is objectionable on the same grounds. It is essential to warn the man against rubbing or scratching his ears. The silver nitrate stick should be used to cauterize any fissures which are so often the source of the chronic state.

Earache.—There are three common causes of earache: (1) Acute otitis media; (2) furunculosis; (3) dental caries.

The differential diagnosis is important and generally easy.

(1) Cases of *acute otitis media* occur commonly during an influenza epidemic or in the course of tonsillitis and they should not be treated in the unit. The condition is characterized by pain in the ear and tenderness over the mastoid antrum, deafness and redness of the membrane.

(2) *Furunculosis* appears in small epidemics in the spring and autumn and there are often boils present elsewhere on the patient. If there is no obvious boil just inside the meatus, acute pain on pressure over the tragus or on moving the auricle suggests strongly that a boil will appear in the course of the next day or two. With the exception of a massive furunculosis of the meatus most of these cases can be treated by the medical officer by lightly packing the meatus with strips of gauze which have been soaked in a strong solution of magnesium sulphate or in a saturated solution of magnesium sulphate in glycerin. Outside this and over the ear, dry heat only should be applied. Fomentations and poultices only spread the infection to fresh fields and follicles.

If small intensely painful boils are seen to be within easy reach the tip of each boil may be touched with pure phenol but, of course, extreme caution must be taken that only sufficient phenol to cover the point of the boil is on the end of the probe. This gives considerable relief from pain.

(3) If no explanation for the earache is found in the ear itself, inspection of the teeth will sometimes reveal the cause.

Otorrhœa.—It is a safe rule to regard any foul-smelling discharge from the ear as being due to cholesteatoma or at any rate to a very old-standing otitis. Hence any local treatment in the Field is unlikely to meet with success. Accordingly when such a case is encountered it should be sent to the specialist who can treat it and re-categorize it if necessary. It is very

important that recurrences of old otitis if they are accompanied by pain or tenderness over the mastoid should be sent at once. At the same time, medical officers should not fail to obtain the previous history about ear discharge. In many cases referred to the specialist it is obvious from objective examination alone that the condition is of very long-standing and inquiry may elicit a history of discharge from childhood and attendance at a school clinic. The man has probably been content to go on with his discharging ears at his civilian duties and found it of very little inconvenience but, when conscripted, he makes the most of it and wants hospital treatment. If there is no pain or malaise nor any marked alteration in the amount of the discharge, simple cleansing treatment will keep the ears comfortable.

These cases should be considered in the light of the circumstances of the moment. If the man can be easily spared for a time for intensive local treatment and, concurrently, the correction of any nasal or nasopharyngeal condition prejudicial to recovery, by all means let him have it. If, however, there is pressure of work, the medical officer need not be unduly anxious about most of these cases provided pain and malaise are absent.

On the other hand, if the ear shows a mucoid discharge and if this coincides with a head cold, probably it is a flare-up of an old otitis and the discharge is really an extension of the cold along the Eustachian tube, i.e. it is a mucosal condition only. These cases can very readily be treated in the Field. It is essential to recognize that the head cold is the initial cause and this should be treated with aspirin and an alkaline mixture or with bicarbonate of soda alone (20 grains every four hours is adequate). The local treatment should start off with a thorough cleansing of the meatus, by syringing if necessary. After the ear is completely dry, pulv. ac. boric. is insufflated in sufficient quantity to fill the meatus. A makeshift insufflator can be made out of one of the various hypodermic syringes provided that it is washed and dried carefully after it is used. The insufflation of the powder need only be repeated if and when the discharge reappears. As the discharge decreases in amount it will be found that it moistens the powder less and less until one day the powder is found to be dry. When this happens it should be left alone for three to four days and only if the hearing is deficient need some of it be removed.

Deafness.—Any estimation of hearing capacity in the Field must necessarily be by a rough and ready method but it is possible to say easily whether a man is category A1 or not. The criterion is whether a forced whisper can be heard at 10 feet with both ears open. The method of testing is as follows: The medical officer stands behind the patient who is told to listen attentively and to repeat anything he hears immediately he hears it. To produce a "forced whisper" take a deep breath and hold it while you whisper as loudly as possible without producing the spoken voice. It is essential that the man should not see the examiner's lips in order to exclude the possibility of lip-reading. To illustrate this point one case may be quoted.

A Lance-corporal was sent to the Base Hospital because of deafness which was said to have been produced suddenly by a shell bursting near him. He was not wounded in any way nor did he suffer from concussion. His medical officer wanted to know the nature of the deafness and in which category he should be placed. I saw the case about three weeks after the alleged cause of the deafness. Examination revealed a very marked nerve deafness with both membranes intact and healthy. The hearing fields as far as I could test them with tuning-forks showed a complete loss of hearing in both ears and the use of Bárány's noise box, etc., seemed to confirm this. In gunfire or shell deafness as a rule the upper tones alone are lost. On questioning the man carefully he confessed the real story which was a surprising one. Five years ago he tried to enlist in a certain famous regiment because his family had always been in that regiment. He was rejected because of his deafness which he admitted had been present since late childhood. So disappointed was he that he determined to learn lip-reading and try again. For three years he took lessons and practised lip-reading until he felt confident enough to make his second attempt. On this occasion he managed to pass undetected and was enrolled. In this training he showed no evidence of deafness as he followed orders on the parade ground quite easily and he did so well that, before being drafted to France, he was promoted Lance-corporal. In France, however, he struck a snag on his first night patrol and he had to confess to his officer that he could not hear anything in the dark. Having confessed he pleaded with me not to send him home. On testing him again by allowing him to see my lips, I found he could repeat what I was whispering at a distance of 20 feet with the greatest of ease.

Deafness and Malingering.—As a rule a man suspected of attempting to mimic deafness should be examined by a specialist but a surprising number of cases can be caught out quite simply. No hint that he is suspect should be given while the man's story is being listened to and the simple hearing tests should be carried on in a loud voice as if he were deaf. At the end of the examination, while the medical officer is writing some notes of the case and the man is momentarily off his guard thinking his ordeal is over, a simple order should be given in a quiet voice, e.g. "Stand up" or "Turn to your right," and it is surprising how often the malingerer will fall into the trap.

Epistaxis.—The cause, in the vast majority of cases of epistaxis, is an undue dryness with consequent crusting in a limited area of the anterior end of the septum. Anything which disturbs a crust over the network of little veins in this area may start the bleeding so the most trivial causes may be blamed for the epistaxis, e.g. stooping or blowing the nose gently. This area of the septum can be located by inserting the finger just inside the nose and pressing on the septum—the tip of the finger then covers the area. Pressure can be made on it by pinching the nose between the finger and the thumb. If this pressure is maintained for ten minutes—the patient

meantime breathing through the mouth—the vast majority of these mild cases can be controlled. It must be remembered, however, that merely controlling the bleeding when it occurs does not diminish the likelihood of recurrence. In order to effect this, an ointment should be prescribed such as vaseline or liquid paraffin to soften the crusts and thus allow the mucous membrane to heal over. It should be used three times daily for three to four days. If the bleeding amounts merely to a slight ooze a little adrenalin may be added to the ointment, say 5 minims to the ounce. Only after this treatment has failed should a case of epistaxis be referred to the specialist for cauterizing.

Sinusitis.—Apart from the usual treatment by aspirin or M & B 693, frontal and maxillary sinus pain can be greatly relieved by simple inhalations of steam. In addition, all these cases should have sodium bicarbonate 20 grains by mouth thrice daily for two to three days. The object in giving this is to thin out the extremely tenacious mucus which clogs the ostia of the sinuses in these cases.

Tonsillitis.—One comment which I should like to make on this condition is to advocate what will seem a counsel of perfection to Field units; that these cases should be isolated if at all possible. Only by doing this can the little epidemics which periodically occur in units be avoided. In crowded billets and tents I know that this is difficult but the trouble and effort taken at making some attempt at isolation will be repaid in the avoidance or the limitation of the number of cases affected. In this condition it is not necessary to suggest tonsillectomy because a man has had a sore throat but a history of repeated sore throats and particularly of quinsies is a definite indication for the operation.

I have to thank Colonel R. G. Atkins for his helpful suggestions and for his permission to send this paper for publication.

SPRAY-PROOF FIELD COOKHOUSE.

BY LIEUTENANT-COLONEL EDGAR WALSH,
Royal Army Medical Corps.

THE necessity for finding cover for a Field Cookhouse, where buildings or other protection were not available, led to experiments with pent-house equipment.

Material Required (Fig. 1).

- (1) Pent-house equipment from one lorry.
- (2) Two rot-proof covers from Company G. 1098 equipment.
- (3) A quantity of stout cord or twine.

Method Employed.

- (1) Two upright tubular supports from one side pent-house were connected by the corresponding tubular cross-pieces.

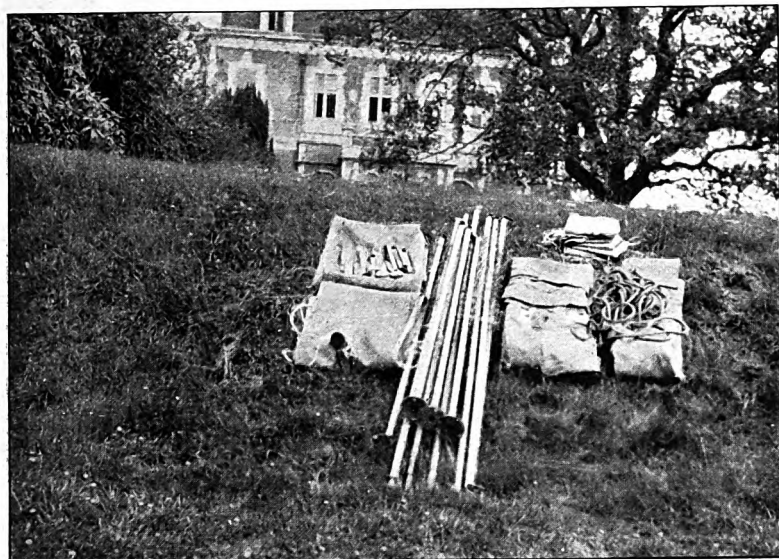


FIG. 1.

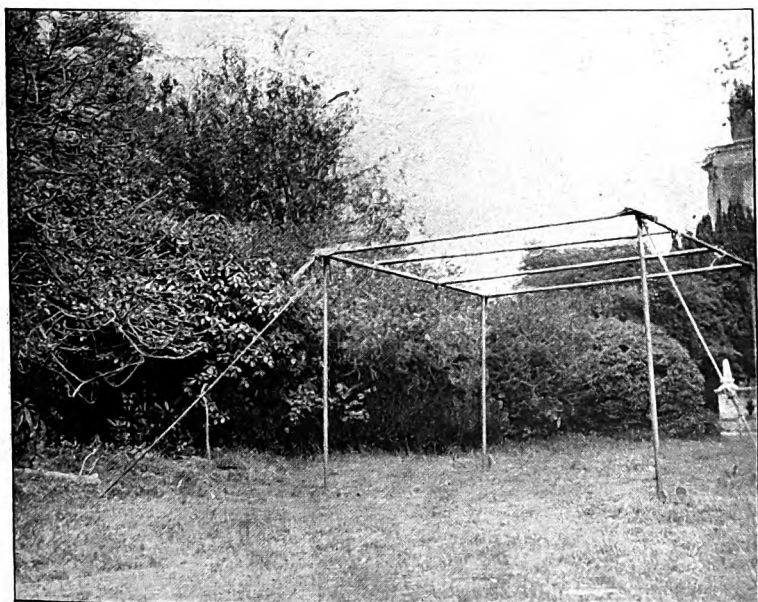


FIG. 2.

(2) The tubular supports from the other side were likewise connected.

(3) Two side supports (usually inclined from lorry) connected the ends of these two sections together, the eyelet end fitting on to the projecting end of one cross-piece and the horse-shoe near the end of the second cross-piece. The second pair of side supports were placed at intervals across the frame-work to prevent the roof sagging.

Thus a rectangular framework was constructed on four tubular supports, about 8 feet square, front height 6 feet, rear 5 feet 6 inches, and stayed at the corners with the guy-ropes supplied with pent-house (fig. 2).

(4) Two rot-proof covers, overlapping in the centre, were now drawn over the framework and secured by twine through the eyelet holes to pegs



FIG. 3.

in the ground, the twine crossing over to hold the rot-proof covers together. Side pieces were hung on the two weather sides and lashed to the uprights by cord provided (fig. 3).

General Notes.

(1) The *rear uprights* were sunk about 6 inches in the ground to give slope to the roof.

(2) Sandbags were folded and placed over friction points and under rot-proof covers to prevent undue wear.

(3) Pent-house sides only were used. The ends could have been used to further enclose the structure and complete black-out.

(4) Rot-proof covers are 10 feet by 6 feet, so that there is about a foot of overhang all round, thus carrying water clear of the sides.

Advantages Over Pent-house.

- (1) *Can be erected anywhere*, e.g. where it is impossible to take a lorry on a level patch of ground too small for lorry and pent-house.
- (2) *Lorry* is not immobilized and thus can be used for other purposes, e.g. removing wounded, moving personnel, bringing up rations and stores.
- (3) *Easily camouflaged*; could be erected under trees.
- (4) Easily transportable; could be carried by two stretcher squads.
- (5) Risk of fire to lorry with cook-house under pent-house.

Uses.

Field cook-house, dressing tent, operating tent, bivouac, office, store, mess, decontamination shelter, etc.

Reviews.

HANDBOOK OF PRACTICAL BACTERIOLOGY. By T. J. Mackie, M.D., D.P.H., and J. E. McCartney, M.D., D.Sc. Sixth Edition. Edinburgh: E. and S. Livingstone. 1942. Pp. viii + 675. Price 17s. 6d. net.

Since the first edition of this justly popular book appeared in 1925 it has grown alike in size and usefulness, and an ever-growing band of students and laboratory workers has good reason to be very grateful to Professor Mackie and Major McCartney. In the present edition the text has been thoroughly revised and much new material has been added. The reader will find a description of the recently introduced desoxycholate-citrate dysentery medium and also a description of the use of para-amino-benzoic acid in the bacteriological examination of material from patients under treatment with sulphonamide derivatives, to mention but two of the many additions to the new issue.

One hesitates to criticize a book so excellently produced in war-time but one is prompted to suggest that a greater difference between the two sizes of type might indicate more clearly what is intended to be fundamental and what accessory information. As an instance, the section on diphtheria contains the soundest teaching regarding the necessity for the performance of virulence tests on cultures recovered from all but clinical faucial diphtheria. At the same time the not-so-small print suggests that strains may be designated as virulent by cultural and biochemical tests. To the experienced bacteriologist the meaning is clear but this book has come to be almost the bible of many young laboratory workers. It is important, therefore, that no part of it should be misunderstood.

This is, however, a small blemish in a book that well maintains the high standard set by previous editions.

H. J. B.

PATHOLOGY AND TREATMENT OF WAR WOUNDS. By Sir Almroth E. Wright, M.D., F.R.S. London: William Heinemann (Medical Books) Ltd. 1942. Pp. viii + 208. Price 21s. net.

At a time when so much active research is concerned with wound infection it is especially interesting to re-read Sir Almroth Wright's lectures on the same problems as they appeared in the last war. If the present war has led to the appreciation of additional factors that retard healing, the problems regarding the infection of wounds still occupy the first place.

We may have gone a long way on the road of development of technique but it is to be doubted if any experiments have ever been more beautifully demonstrated than those by the Master of the Teat and the Capillary Glass Tube.

There will be many who will be grateful for the publication of this collection of Sir Almroth's lectures and writings. H. J. B.

STITT'S DIAGNOSIS, PREVENTION AND TREATMENT OF TROPICAL DISEASES. By Richard P. Strong, M.D., Sc.D., D.S.M., C.B. Sixth Edition. Two Vols. London: H. K. Lewis & Co. 1942. Pp. cii + 1747. Price £5 5s. net.

After thirteen years a sixth edition of "Stitt's Diagnostics and Treatment of Tropical Diseases" has appeared under a new title. The scope and size of the book have been greatly increased under the editorship of Professor R. P. Strong, Consultant on Tropical Medicine to the U.S. Secretary of War and Emeritus Professor of Tropical Medicine, Harvard University.

There are two volumes, each of more than 800 pages. Vol. I contains the protozoal and bacterial diseases presented in alphabetical order, while Vol. II deals with those due to viruses, rickettsiæ, nutritional disorders, fungus infections and animal parasites. Illustrations are profuse and clear with two excellent plates in colour showing forms of malarial parasites in thick and thin blood films.

The account of malaria and blackwater fever is probably the most complete and accurate in the English language. Modern sulphaguanidine therapy is fully considered in the description of bacillary dysentery. It is disappointing to read that "Boyd (1940) has still further complicated the matter of the classification of the dysentery bacilli." Readers of Colonel Boyd's articles in this journal will not support this view.

There are admirable accounts of yellow fever, the typhus group and trench fever. Inadequate space is allotted to sprue which is now included as a nutritional disorder. There is some repetition of the sections on entomology, for they appear under the appropriate diseases as well as in a chapter devoted to arthropods in the transmission of disease. The appendix, consisting of an index of clinical and laboratory diagnosis and a synopsis of tropical and personal hygiene, is one of the most valuable parts of the book.

To those medical officers who have used "Stitt's Practical Bacteriology,

Hæmatology and Parasitology" in clinical siderooms and laboratories, a new edition of "Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases" will be especially welcome. Though now of some bulk, this is one of the great works on Tropical Medicine and Professor Strong and his collaborators are to be congratulated that it has been re-written when full consideration is being given to the relation of these diseases to war time conditions.

W. R. M. D.

THE WAR ON THE CIVIL AND MILITARY FRONTS. By Major-General G. M. Lindsay, C.B., C.M.G., D.S.O. Cambridge University Press. 1942. Pp. xii + 112. Price 5s. net.

The author, in his preface, recites at some length his claims for writing this little book and demands the admission that the two outstanding weapons of modern war are the machine gun and the tank; the Air component is mentioned later.

The totalitarian nature of modern war is described, but no mention is made of the fact that an intense national ideology and a universal "will to win" mentality is vitally necessary for ultimate victory.

The lessons to be learned from Lord Gort's despatches are well brought out and one criticism quoted: "... there was nothing wrong with the decision to advance into Belgium; what was not just wrong but criminal was to advance with 1914 troops to meet the German 1940 military machine."

The chapter on armoured formations should not be read without reference to the latest war establishments and consideration of air co-operation.

Free use is made of the material supplied in "Blitzkrieg" by F. O. Miksche, an appreciation of which has already appeared in the R.A.M.C. Journal.

The latter portion of the book deals with invasion problems in this country and an opinion is registered that all able-bodied men of the Civil Defence Services should be trained to arms.

"Defence Committees" are described in the South-Western Region but no credit is given to the Eastern Region which originated the idea.

This is a book which will inspire thought on the part of those readers who are already conversant with the subject.

E. M. C.

THE MODERN TREATMENT OF VENEREAL DISEASES. By E. T. Burke, D.S.O., M.B., Ch.B.Glas. London: John Bale Medical Publications, Ltd. 1942. Pp. 105. Price 12s. 6d. net.

Burke's "Modern Treatment of Venereal Diseases" contains essentially the same matter as the treatment section of his larger book "Venereal Diseases." Suffice it to say that Burke is a strong advocate of the alternating-continuous method of treating syphilis as opposed to the concurrent-intermittent and that all treatment of the disease in its early stages is based on an "Efficiency Index"; this latter has not been adopted by any consider-

able number of syphilologists. No less than 64 pages are devoted to syphilis whilst only 28 are allotted to all the other forms of V.D., including gonorrhoea, chancroid, *Trichomonas* infestation, gangrenous balanitis, and lymphogranuloma inguinale. Many people will regard thrice weekly injections of arsenic as impracticable in the case of the average out-patient and the use of sulphonamides over a continuous period of fourteen days as unwise to say the least of it. This little book is not one for the general duty officer or general practitioner but the specialist in venereology will find in it much that is stimulating. It is well got up and errors and misprints are rare but 12s. 6d. seems a high price to pay for no more than 105 pages.

T. E. O.

PULMONARY TUBERCULOSIS AND ITS TREATMENT. By Hans Jacob Ustvedt (translated by A. L. Jacobs, M.R.C.P.). London: John Bale Medical Publications, Ltd. 1942. Pp. xv + 252. Price 25s.

This book has been written by one who thoroughly understands the problem which he faces and who has given deep thought to the theoretical side of many of the, as yet, unsettled questions of the aetiology of tuberculosis. If this review appears critical it is because many of these latter questions invite controversy; but it may be as well to state at the commencement of the brief consideration that we are able to give it that the book greatly appeals to us and that we have read it with the deepest interest and admiration.

It is evident that the work of Ustvedt has been very largely confined to studies of the kind which have been long known to British phthisiologists from the writings of Heimbeck and Scheel. It may be that his insistence upon erythema nodosum as a very frequent accompaniment to the first stage of tuberculous disease is a result of his having observed this condition in nurses and students at one time found to be tuberculin-negative but now struggling against an early manifestation of clinical tuberculosis.

This has not been our experience in the medical students whom we have studied but it must be added that our observations were confined to a couple of hundred and that the number developing disease was minimal. In the case of nurses we have never attempted to tuberculin-test the new entries and so here too, our knowledge is incomplete. It is curious, however, to find this great stress laid on erythema nodosum which has been, in our experience, rather rare. Perhaps the disease is not noticed much by us or by our German relations and that cases are passed on to uninterested skin specialists as suggested by Ustvedt; but we doubt if dermatologists are really so behind the times. In the portion of the book dealing with the aetiology of the disease we thoroughly agree with the author in his classification of "Factors inherent in the Infecting Organism." We agree, too, that the only germ is Koch's bacillus and that the question of a filtrable virus may be ignored, that the human variety is by far the commonest infective agent

in man and that the virulence of the infecting germ remains much the same whether it is cultivated from a rapidly advancing case of progressive phthisis or from a "chronic" patient in relatively good health. We differ, however, with regard to the "infecting dose." Ustvedt appears to consider that, though different amounts of tubercle bacilli inoculated by subcutaneous or intravenous injection into laboratory animals admittedly bring about a more or a less virulent course according as the dose is great or small, the infective dose for the human subject is a matter of indifference. There is, of course, the "primary affect" which usually consists of *one* primary focus—though there may be several—and the accompanying pulmonary and bronchial glands and it might be argued that as there is only one point of entry, there has been only one infection. We find it impossible to believe, however, that the primary focus represents the *only* infection of an infant. We regard the primary focus as the principal but by no means the only entry. There may have been a great many infections of the pulmonary alveolar system immediately before or immediately after the primary focus which, lacking the numerical power or arriving on a now allergic tissue, have failed to establish a visible lesion but which count in the sum of infection nevertheless. But this is a theoretical conception not subject to proof and the author may yet turn out to be right or wrong. We think that he is wrong and we ask him to explain why it is that only one out of many germs in the air of an infected house attacks the child breathing this contaminated atmosphere and why the children of infected parents get so much more tuberculosis than the children of the healthy? There are many points as to which we might choose to differ but time is short and space is now very important. We congratulate the author on what is a thoroughly modern and a very excellent summing-up of a most difficult and a most intriguing subject.

Notice.

SULPHAGUANIDINE.

SULPHAGUANIDINE-BOOTS is a new sulphonamide which has low toxicity and is stated to have given excellent results in the treatment of bacillary dysentery and other intestinal infections. It has also been used with success in the treatment of cholera and as a prophylactic in surgery of the colon and rectum.

The initial dosage for children and adults is 0.1 gramme per kilogram (2.2 pounds) body weight. Sulphaguanidine-Boots is supplied in tablets each containing 0.5 gramme ($7\frac{1}{2}$ grains). Bottles of 50 tablets.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. All such articles or papers, etc., intended for publication must be submitted in duplicate through the proper channels, i.e., Commanding Officer and A.D.M.S., or D.D.M.S., to the Under-Secretary of State, War Office P.R. (C. & P.), and not to A.M.D.2, otherwise such articles are liable to be returned to the authors and this may cause delay in publication.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

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We are privileged to publish the following correspondence which passed between the Acting Private Secretary to Her Majesty The Queen and Lieutenant-General Sir James A. Hartigan, K.C.B., C.M.G., D.S.O., Representative Colonel Commandant, on the occasion of the gracious acceptance by Her Majesty The Queen, Colonel-in-Chief, Royal Army Medical Corps, of a Corps Brooch, as announced in the September number.

*Lieutenant-General Sir J. A. Hartigan, K.C.B., C.M.G., D.S.O.,
Marlborough Court,
Lancaster Gate, W.2.*

MY DEAR GENERAL,—The Queen desires that I should write to you in reference to the brooch which, on behalf of the Royal Army Medical Corps, you presented to Her Majesty in July.

The Queen is sure that you will know, yourself, what pleasure this present gave her, and it was Her Majesty's hope that she might have had the opportunity in London, before now, of expressing to some of those whom you represented her thanks for a gift which she greatly values.

As you are aware, unforeseen circumstances have unfortunately made this impossible, and The Queen hopes, therefore, that you will assure those who have been associated with this present how sincerely she appreciates this token of their goodwill and how happy she is to be Colonel-in-Chief of their Regiment.

Yours sincerely,

(Sgd.) ARTHUR PENN,
Acting Private Secretary to The Queen.

*Buckingham Palace,
October 9, 1942.*

*Captain Arthur Penn,
Acting Private Secretary to The Queen,
Buckingham Palace.*

DEAR CAPTAIN PENN,—I would be very grateful if you would convey my humble duty to The Queen and express to Her Majesty the respectful thanks of the Royal Army Medical Corps for her generous appreciation of the brooch which she honoured us by accepting in July last.

Steps will be taken to ensure that Her Majesty's most kind message, and the gracious expression of her happiness at being our Colonel-in-Chief, will be conveyed to all ranks, by whom it will be immensely appreciated.

We deeply deplore the special circumstances to which your letter refers, and I beg respectfully to assure Her Majesty that the members of her Corps share to the full the profound sympathy felt by the whole nation for the Royal Family in their great sorrow.

Yours sincerely,

(Sgd.) J. A. HARTIGAN.

*Marlborough Court,
Lancaster Gate, W.2,
October 14, 1942.*

Authors are alone responsible for the statements
made and the opinions expressed in their papers.

Journal of the Royal Army Medical Corps.

Original Communications.

WITH A FIELD AMBULANCE IN LIBYA.

BY CAPTAIN W. T. E. BLACKMORE, R.A.M.C.,
Assistant Instructor Officers' Wing—Depôt R.A.M.C.

COMMAND of a Field Ambulance entails the careful consideration and satisfactory solution of a host of problems, varying in type from the correct tyre pressure in a load carrying vehicle to the ingredients of the evening stew and, of these, not the least is the problem of distances.

Disposition distances for A.D.Ss. and M.D.Ss. and movement distances for bounds are not only the subject of inspired calculation but also the source of many a persistent headache, for they must be considered not only from the medical angle but also from the "Q A" point of view.

While the opportunities for treatment will necessarily be limited by the strategical situation, it is axiomatic to state that the role of the Field Ambulance, and more especially the Light Field Ambulance, must always be the adequate treatment of casualties and their rapid evacuation out of the forward area without at any time losing its mobility.

Events in the present conflict have moved so rapidly that the only theatre of operations which has so far presented opportunities for the study of Field Ambulance tactics in modern warfare has been the Middle East.

These notes are based upon my experiences in this area as second in command of a Light Field Ambulance in addition to periods of duty as D.A.D.M.S. and E.M.O. during the Wavell campaign in Libya.

The campaign in Libya has been taken for analysis not only because it provides an excellent example of a complete operation over a definite period of time but also since it was an operation of advance and presumably the precursor of similar future operations.

The material gains from this campaign are not detailed nor has it been

considered necessary to describe the local conditions, the comparative shortage of rations and water or the difficulties of supply and replenishment, since these are, by now, common knowledge.

It is impossible also, for security reasons, to describe the methods employed in supply and replenishment other than to say that they were, in spite of conditions and considerable difficulties, in every way excellent.

THE ARMoured DIVISION.

The Armoured Division to which our Field Ambulance was attached went into action on December 9, 1940, and was relieved on March 5, 1941, a period of eighty-six days of hard fighting and rapid movement.

Casualties from this Division and, on one occasion from the Division on our flank, were dealt with by two Light Field Ambulances, each equipped to establishment, so that two Main Dressing Stations and eight Sections were available.

EMPLOYMENT OF FIELD AMBULANCES.

The method of employment of Field Ambulances during the entire period was that of using Main Dressing Stations in échelon with some sections brigaded as Advanced Dressing Stations and others sited for other functions in accordance with the situation.

On some occasions, when the intervening distance was rather great, a section was situated between the advanced and rear M.D.Ss. and on other occasions sections were opened for similar reasons between the rear M.D.S. and the C.C.S.

The combination of two or three sections to function on a forward Advanced Main Dressing Station was often found advantageous, both for operation reasons and as a foundation on which the M.D.S. proper could be built lorry by lorry, if necessary.

TABLE I.

<i>Date.</i>	<i>Advanced M.D.S. Station.</i>	<i>Distance travelled by Adv. M.D.S., in jumps. Kilos.</i>	<i>Distance from nearest A.D.S. Kilos.</i>	<i>Distance from rear M.D.S. Kilos.</i>	<i>Distance between rear M.D.S. and C.C.S. Kilos.</i>	<i>Distance between C.C.S. and nearest G.H. Kilos.</i>
Dec. 8, 1940	Sinia Road ..	—	10	45	105	168
" 9, "	Bir Thalata ..	95	6	50	75	288
" 15, "	Bir Enba ..	50	45	125	75	288
" 17, "	Bir Sofafi ..	35	30	55	150	288
" 21, "	Bir Kheregat ..	50	25	105	150	288
" 23, "	Bir el Maraa ..	45	20	90	185	288
Jan. 6, 1941	Bir el Hamarin ..	25	30	60	80	408
" 9, "	Hagfet el Nezha ..	80	20	80	160	408
" 20, "	Ain el Gazala ..	85	20	75	230	408
" 26, "	Bir el Aleima ..	45	25	95	30	658
Feb. 2, "	Div. Axis ..	35	22	80	90	658
" 7, "	Mechili ..	35	15	25	200	658
" 9, "	Solluch ..	240	30	240	200	440
" 16, "	Ghemines ..	22	40	75	50	50
Feb. 28	Beda Fomm					
Mar. 5, 1941	(R.V.) Cairo ..	65	—	—	—	—
	Average ..	65 kilos.	25 kilos.	85 kilos.	128 kilos.	378 kilos.
	Distances ..	40 miles.	15 miles.	53 miles.	80 miles.	236 miles.

THE C.C.S.

The role of Advanced C.C.S. was carried out by the H.Q. and Companies of the Corps Field Ambulance—a very necessary procedure in view of the rapid movement.

The distances table shown above demonstrates that a C.C.S. with normal establishment would have been much too static adequately to have coped with the situation.

GENERAL HEALTH.

At the same time general health remained, on the whole, surprisingly good.

Desert sores, inflammation of areolar tissue, were fairly common but only in severe cases resulted in incapacitation.

It was notable that these sores occurred only on the exposed parts—hands, forearms, knees and neck—and it is possible that the devitalization of the skin by over-exposure to the sun, plus the abrasive action of sand particles, may have been a causative factor.

Ascorbic acid tablets were administered as a routine measure with some units to counteract any possible vitamin deficiency but, as cases occurred at more or less equal rates in treated and untreated units, the value of this procedure was doubtful.

Mild gastric enteritis, the “gyppy tummy” type, occurred fairly frequently but was as a rule of moderate severity and only a small percentage of cases required evacuation to the base.

Cases of jaundice were not uncommon the cause of which was difficult to establish but it was considered likely that the severe fall of temperature at night had some bearing on the condition. This is very possibly a definite factor in the causation since the extremes in temperatures are very severe indeed, shorts and shirts being quite enough during the day and pullovers, battledress and greatcoat not enough at night.

OPERATIONAL INTENSITY.

It may be thought that an eighty-six day campaign is not an unduly lengthy period but the fatigue consequent upon twenty-four hour duty during this time has to be experienced to be believed.

It must be borne in mind that whereas in the 1914-18 war, short periods of “front-line” duty were alternated with periods of rest at the base, this eighty-six days represents continuous “front-line” duties with all the stress and strain that this implies, plus the absolute absence of any sense of security of position—the order to “up stick and away” could be expected at any time of day or night. In addition, too, there was the ever present menace of air attack, the superiority at that time held by the enemy, enabling him to attack most targets with comparative ease.

During this period we established thirteen Main Dressing Stations, and

a table (Table I) is given which shows the relative positions of supporting medical units and the distances covered.

The average length of stay in stations was approximately six and half days but a closer analysis of figures reveals the fact that during the intensely active periods, two or three days only were spent in each place.

DISTANCES.

The table demonstrates the average distances that existed between Field Ambulance Units.

R.A.P. to A.D.S.—The estimated distances shown on the table between the Regional Aid Posts which, incidentally, were almost invariably the R.M.O.s trucks and the nearest A.D.S. is about 15 to 20 kilos or 8 to 12 miles.

This figure must be taken as very approximate as it varied not only with the situation but also with each particular unit according to its allotted duties.

A.D.S. to Advanced M.D.S.—A figure that on the whole remained fairly constant was the distance between the nearest A.D.S. and the advanced M.D.S.; this was about 12 to 15 miles.

It will be noted that this figure is given for the distance from the nearest A.D.S.: there were at the same time some which were stationed 30 miles away.

Advanced M.D.S. to Rear M.D.S.—The distance between the Advanced M.D.S. and the rear M.D.S. was subject to greater variation.

The average figure works out at 85 kilos or 53 miles but as the figures taken for computation include one enormous jump of 130 miles in thirty hours, which for Field Ambulance movement in the Field must be something of a record, a more accurate figure would be about 75 kilos or 46 miles.

The policy during this campaign appeared to be that of positioning the Advanced M.Ds well forward. At Bir Thalata on December 9, 1940, for example, we were stationed about 8 kilos away from Nibeiwa, the first objective, the tanks actually rumbling their way through us to attack at dawn.

Again, prior to the assault on Tobruk, our station was at Hagfet el Nezha about 10 kilos south of the outer perimeter of the Tobruk defences and the move to our next station, Gazala, was actually made before the township was taken.

The method of progression adopted was that of "leap-frogging" and the evacuation of casualties was carried out by our ambulance cars, together with the valuable assistance of a M.A.C., operating on a "shuttle" system.

Rear M.D.S. and C.C.S.—As the table shows, the average distance between the rear M.D.S. and the C.C.S. was about 128 kilos or 80 miles, but this again was also subject to great variation and the Field Ambulance

employed as a C.C.S. experienced some difficulty in keeping up with the pace of the advance.

Starting off at Mersa Matruh, they had to move in turn to Sidi Barrani (60 miles), Tobruk (120 miles) and Benghazi (450 miles), their work being made none the easier by the fact that the railhead remained at Mersa Matruh.

The Corps Field Ambulance had also to act occasionally as a General Hospital since the nearest one was at no time closer than Alexandria and, when it is realized that this town is almost 1,000 miles from Benghazi, it will be seen that it was not always easy to maintain the chain of evacuation.

C.C.S. to General Hospital.—Since the Field Ambulances were carrying out a dual role for a certain period in the campaign, the average distance between the C.C.S. and the General Hospital cannot be given with any degree of accuracy but a figure of 250 miles between the C.C.S. and the General Hospital treatment would not be very wide of the mark.

FIELD AMBULANCE MOVEMENT.

Fairly accurate figures can be given for the movement of our Field Ambulance. The average distance covered in bounds was about 40 miles but, when the exceptional jump of 130 miles is omitted, a more accurate figure would be about 32 miles.

Most of these moves had to be made at very short notice and, as far as my memory serves, the best time for getting the M.D.S. under way was fifteen minutes.

Various factors, some of them violent, interfered with copious note-taking so that most of the figures given are quoted from memory.

Nevertheless my memory being good, and the distances having been checked on an O.S. map, I can vouch for a reasonable degree of accuracy.

In the light of these experiences in the Western Desert, certain conclusions have been arrived at, and are appended for consideration by Field Ambulance Units.

No apology is made for the unorthodoxy of some of them as in any case this has been a most unorthodox war and it can be truly said that experience proves the best practice.

MAP READING.

The value of training in map reading, use of both the prismatic and sun compass, with a good working knowledge of stellar constellations cannot be underestimated.

All Officers, N.C.O.s and Ambulance Drivers received instruction in this department and the time spent in training was well repaid.

On many occasions when the work had to be carried out during "kham-sins," the hot unpleasant dust-storms so frequently encountered in this region, efficient training in this, plus adequate track-making, saved many who would otherwise have been hopelessly lost.

The comparative infrequency of recognizable features on the landscape made "travelling on a bearing" a matter of daily routine; ambulance drivers very soon became accustomed to it—one imperturbable character whom I can call to mind thought nothing of starting off on a 40 or 50 miles run with no other aid to travel than a rough sketch map of about three pencil lines, the knowledge that his bearing was about 120° , and a toy compass, the type that could be purchased for a shilling before the war, whose angle of magnetic deflection was anything up to 30° —but *mirabile dictu* he always got there and, however bad the going or khamsin, never turned a hair.

SHELTERS.

During the training period, particular attention was paid to instruction in the loading and unloading of vehicles and also the rapid erection and striking of shelter tents, a policy which, during rapid movement, was amply justified.

Penthouse shelters were not an issue at that time. Field Ambulances worked with tarpaulin lean-to shelters, 30 by 40, or 30 by 30, and these to my mind were, in several respects, notably for easy camouflage and greater available floor space for stretcher cases, superior to the penthouse.

P.A.D.

P.A.D. measures again proved the value of dispersion. Two hundred yards between vehicles, both on the move and when established in a M.D.S., was an inflexible rule and the parking of two vehicles together was never permitted, the axiom being that a bomb may hit one truck but it must never destroy two.

It was observed, of course, that bombing always had a salutary effect on this drill and on slit trench digging. A definite drill was laid down for slit trenches—invariably one had to be dug before a shelter could be erected—this proving valuable against surprise attacks.

The shelter itself was dug in wherever possible, or a low sand-bagged wall built around its inside wall, and the lorry engine was protected with a further wall of sandbags.

A slit trench dug under cover of the shelter itself, large enough to take a stretcher and covered with boards until required, proved to be a valuable protection for casualties. Many Field Ambulances are prone to overlook the fact that they are responsible for the safe custody of their patients as well as for their treatment. Air sentries equipped with whistles, both on the move and whilst stationary, were always used as a further P.A.D. measure. Incidentally they had to be relieved hourly as local conditions made it impossible for men to do a longer tour of duty.

MAINTENANCE OF M.T.

Care and maintenance of M.T. was always an important task, efficiently carried out by the transport officer and his R.A.S.C. personnel, but one very

soon learnt that a personal check of a vehicle before proceeding on a journey was always advisable.

The Transport Officer has a full time job and here Field Ambulance Officers, who as a general rule have sufficient technical knowledge for the checking of petrol, water, oil, spares, batteries and tyres and who make it their duty to carry out a brief inspection before starting out, can render much valuable assistance.

A common sense precaution adopted was to encourage the wagon orderlies to learn to drive and maintain a vehicle and, in addition, to teach the drivers something of first aid principles.

This interchanging of duties was very useful; the only drawback, human nature being what it is, was that the drivers were always more interested in the casualties and Nursing Orderlies more interested in the engine.

CLEARING THE FORWARD AREA.

Experience definitely established the conclusion that evacuation must be initiated from before backwards. R.M.O.s all had ambulance cars allotted to their units and cleared their casualties in these vehicles back to the A.D.S.

The depth of the battle zone necessitated this procedure, areas being so great that if A.D.Ss. had been left to clear them, the scheme of evacuation would have been slowed up considerably with a consequent deleterious effect on the condition of the casualty.

This worked very well, as also did the Light Field Ambulances, and it was clear that Field Ambulances of this type were eminently suitable for this type of warfare—a number of light mobile A.D.Ss. being essential for the rapid evacuation of casualties.

SURGICAL TREATMENT.

No unit forward of the rear M.D.S. could undertake any radical form of surgery since it would have entailed the sacrifice of its mobility—the quality that must always be the essential attribute of the Field Ambulance in modern warfare—but one imagines that the use of forward surgical units, sited near the rear M.D.S., can solve this problem.

It will be appreciated that some of the conclusions drawn cannot, for security reasons, be published and also that many that have been drawn are, to some extent, applicable to problems peculiar to desert warfare with its greater fluidity of movement. At the same time a study of continental, Russian and Japanese campaigns will show that a similar degree of mobility may be expected and that the problems that will be encountered may not be so very different.

In conclusion it is emphasized that personnel of Field Ambulance units must be regarded and trained primarily as soldiers; competence in first aid, although essential, must always be secondary to their training as Field Troops.

It is impossible to make a doctor out of an R.A.M.C. recruit in six or twelve months but, if in the same space of time he can march 100 miles in three days on a tin of "bully" and a "billy" of tea and do a full day's work at the end of it, if he can find his way about strange country, with or without a map, without losing his head or himself, can make himself a comfortable "bivvy" out of nothing and can cook himself a good meal with the aid of a mess tin and a handful of wood—then he is likely to be much more of an asset to a Field Ambulance than the man who knows all the knots on all the bandages on a Thomas splint but who cannot fend for himself let alone his patient.

This is the ceiling of competency which must be expected from a soldier and to a greater extent from the Field Ambulance Officer in order to maintain the high standard of efficiency for which the Royal Army Medical Corps has always been renowned.

I am indebted to Lieutenant-Colonel T. P. Buist, R.A.M.C., for his valuable assistance in editing these notes and to the Commandant — Depot R.A.M.C. for permission to forward them for publication.

COARCTATION OF THE AORTA WITH PATENT DUCTUS ARTERIOSUS.

LIEUTENANT-COLONEL J. GIBSON GRAHAM,

Royal Army Medical Corps,

AND

CAPTAIN J. D. OLAV KERR,

Royal Army Medical Corps.

WHILE serving in a military hospital, it has been our good fortune to see a considerable number of patients with congenital heart disease. One of these with coarctation of the aorta presented certain unusual features, notably patency of the ductus arteriosus. In themselves these two defects are not amongst the rarer developmental abnormalities of the cardiovascular system but their combination in a diagnosis made during life appears to be sufficiently infrequent to justify detailed consideration.

Evans (1933) stated that coarctation of the aorta was found in approximately one in every thousand necropsies, while Blackford (1928) estimated the incidence as one in 1,550 necropsies.

Patency of the ductus arteriosus occurred in 262 of Abbott's (1936) series of 1,000 cases of congenital cardiac defects. In 40 it was combined with pulmonary atresia or stenosis, in each instance being associated with a septal defect. In the same series of 1,000 cases she described 178 examples of coarctation of the aorta, of which 105 belonged to the adult type, 70 being analysed in detail, and in only 6 of these was the ductus arteriosus patent.

DESCRIPTION OF THE CASE.

Our patient, aged 25, was the wife of a corporal. There was nothing of note in the family history. Both parents, her sisters and two brothers were alive and well; her husband was in good health. She herself could remember no previous illness apart from diphtheria at twelve years when she was ill for six weeks. As a child she had made no complaint of breathlessness and took part in all games when at school with enjoyment. Later she was employed as a shop assistant without incident. She was married at the age of nineteen and evidently was a most active housewife. A year later she became pregnant and at the seventh month began to suffer for the first time from headache, nausea and vomiting which was difficult to control. While no oedema was observed, albumin was present in the urine, and on the fifth day of severe symptoms the pregnancy was terminated. It should be noted that there was no history of convulsions. All symptoms disappeared in three days but she was told she had "kidney trouble" and that another pregnancy would be strongly contra-indicated. This unfavourable prognosis apparently induced an element of introspection and doubt as to her own wellbeing which led the patient to present herself at various hospitals for examination; however, apparently little was found amiss. In

September, 1940, she was six weeks in hospital with a diagnosis of pyelitis. At this time there was some dysuria which has continued to a lesser extent, but at no time has polyuria been noted.

She came under the care of one of us (J. G. G.) some four months later with a provisional diagnosis of chronic nephritis. She made no specific complaint apart from slight discomfort on micturition and lumbar pain when tired. However, she volunteered that she became breathless on exertion and that her lips occasionally turned blue, her nails becoming blue easily in cold weather. She also stated that her feet were always cold, although there was no history of chilblains or of intermittent claudication.

The patient was of small build and stature (height 4 feet 11 inches; weight 91 pounds), being somewhat pallid and wax-like in complexion. On admission to hospital there was no cyanosis or clubbing of the fingers nor was there any evidence of dilated vessels in the thorax. There was, however, marked arterial pulsation at the root of the neck. Neither dyspnoea nor orthopnoea was noted. Physical examination of lungs, abdomen and nervous system did not show any abnormality.

Cardiovascular System.—The pulse rate was 70 per minute, the rhythm being regular and the force good, but the pressure was higher at the left wrist than at the right. The vessels were not palpably sclerosed. Pulsation could not be detected in either the abdominal aorta or great vessels of the lower limbs. Palpation showed the apex beat to be in the fifth left interspace four inches from the mid-line. There was marked pulsation of both carotids, and also of the aorta in the episternal notch, but no tracheal tugging. Percussion did not elicit any obvious change in cardiac dullness. On auscultation at the apex three heart sounds were heard, the third following at a short interval after an apparent second sound. One inch internal to the apex beat systolic and diastolic murmurs were present, the heart sounds themselves being well heard and of good tone. At this point the third sound was not audible and the diastolic murmur partly obscured and followed the second sound. There was nothing to suggest the presence of a presystolic murmur. At the aortic cartilage and down the sternum to the xiphoid there was a systolic murmur but the second sound was pure. Over the aorta and great vessels a systolic bruit was heard, and also in both interscapular areas, especially at the third and fourth left interspaces. In the second left interspace in front, about one and a half inches from the mid-line, a continuous machinery murmur of the water-wheel type was heard, being crescendo during systole and continuing throughout diastole. This murmur was also conducted up to the left clavicle. Throughout the period of observation there were considerable variations in systolic blood-pressure from day to day, but at first there was a constant difference of some fifty millimetres of mercury between the readings obtained in the two arms, the left being the higher. The readings in both upper limbs were greatly in excess of those in the legs, typical figures being:—right arm 175/90, left arm 225/110, legs 130, systolic.

On admission the urine showed a trace of albumin and contained a few polymorphs and coliform organisms. No casts were found. A urea concentration test gave a figure of 2.65 per cent at the second hour. The blood urea was 39 mgm. per cent. Later the urine became normal.

A gynaecological examination did not reveal any abnormality.

Blood Examination.—Hæmoglobin 82 per cent., red blood cells 4,700,000/c.mm., white blood cells 11,200/c.mm. Examination of blood films, including a differential count, did not reveal any abnormality. The

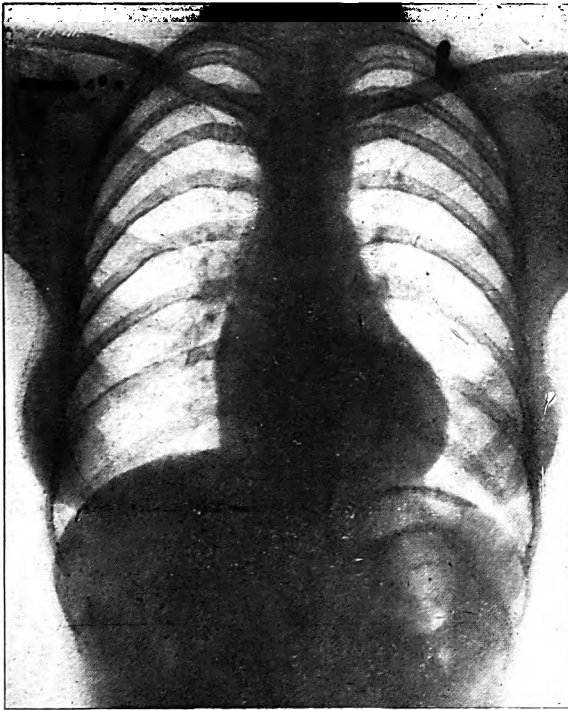


FIG. 1.—Anteroposterior view of our patient, at 2 metres, showing right sided cardiac enlargement, and erosion of ribs.

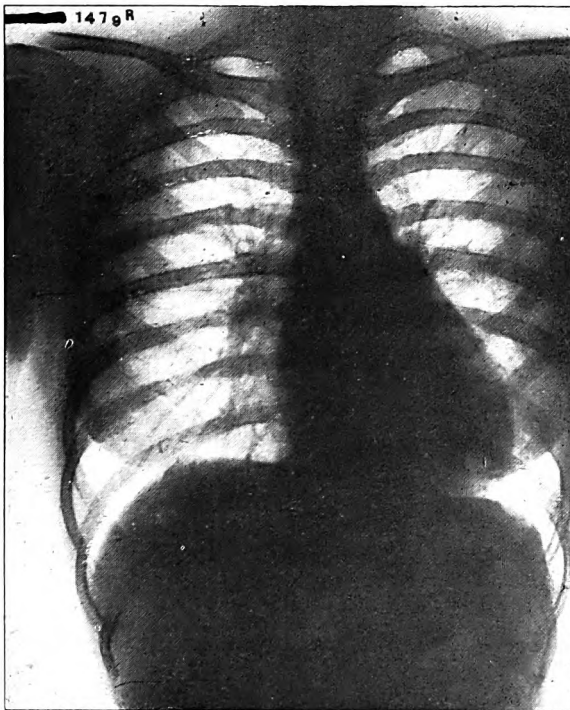


FIG. 2.—Anteroposterior view at 2 metres of an uncomplicated case of patent ductus arteriosus.

Kahn test was negative. The blood sedimentation rate was well within normal limits.

Ophthalmic Examination.—The pupils were always moderately dilated and unequal. The degree of inequality varied from day to day. Sometimes the one and sometimes the other was the more dilated. The reactions both to light and to convergence were sluggish. The fundi showed no evidence of arterial or venous pulsation or any other abnormality.

Radiological examination of the chest showed enlargement of the right ventricle and a prominent and pulsatile conus. The aortic knuckle was somewhat small and, while oblique views revealed an apparently normal ascending and transverse aorta, the remainder of the area could not be visualized. In the left oblique position the aorta and its branches, as Lewis (1931) has described, seemed to rise as a column from the heart shadow up into the root of the neck.

Rösler's sign—erosion of ribs—was present. This is clearly seen in fig. 1, antero-posterior view taken at two metres. Fig. 2, a similar view from one of our uncomplicated cases of patent ductus arteriosus, a female aged 28, is included for comparison. In fig. 3, a left oblique view of the subject of this paper, the prominent pulmonary conus is well seen, but the descending arch of the aorta is not visualized.

An electrocardiogram, fig. 4, shows changes in the ventricular complexes comparable with those described by Evans and Turnbull (1937), following the work of Wilson *et al.* (1934), as denoting right bundle branch block. This newer curve, which is said to be much commoner than the one standard for right bundle branch block, is characterized by a deep S wave as a component of a wide QRS complex in lead I (measuring 0.12 sec. in this case), and also in lead II. The QRS complex in lead III is directed downwards. The T wave is upright in leads I and II and is inverted in lead III. The changes seen in the sternal lead from our patient would seem to be in conformity with this diagnosis.

After three weeks' rest in bed the patient stated that she felt fitter in all respects. She had been afebrile throughout this period. The difference between the two radial pulses and the two brachial blood-pressure became much less marked. The systolic pressure in the arms, however, remained considerably in excess of that in the legs; typical findings were: right arm 205/120, left arm 215/120, legs 130 systolic.

We have pleasure in acknowledging our indebtedness to Major W. C. Armstrong, R.A.M.C., Major E. G. Recordon, R.A.M.C., and Lieutenant D. H. Cummack, R.A.M.C., for the gynaecological, ophthalmic and radiological examinations, and to Mr. R. P. Danskin, of Edinburgh Royal Infirmary, who took the electrocardiogram.

DISCUSSION.

This case presents many unusual features, both in the history and clinical findings. There had been no evidence of cardiac insufficiency until the patient's twentieth year when she was a seven months primigravida. At that time the development of headache, nausea and vomiting, combined with the presence of albuminuria, were interpreted as being due to renal disease. In view of her subsequent history and the results of the present investigations (which, *inter alia*, show no evidence of impaired renal func-

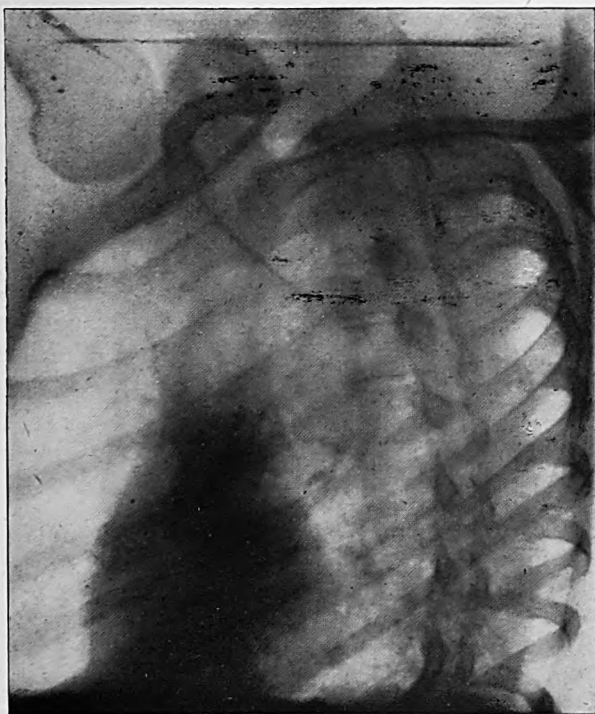


FIG. 3.—Left oblique view of our patient.

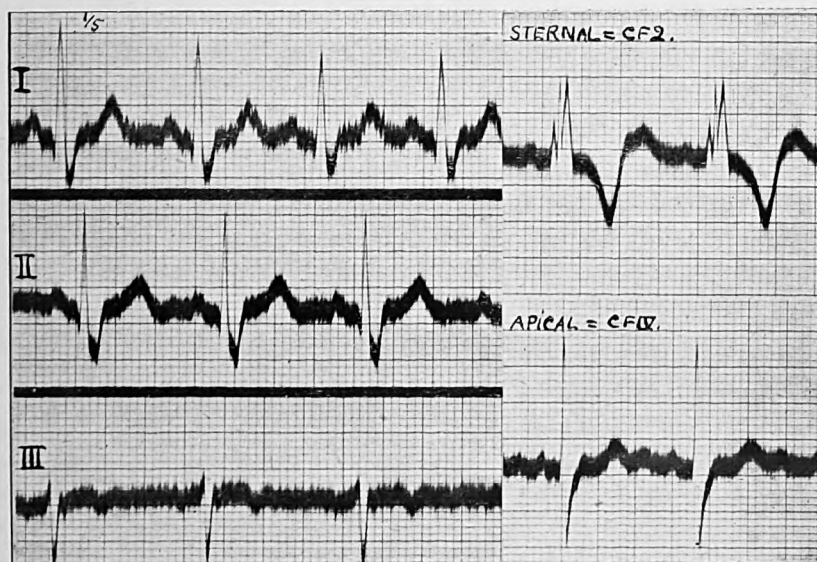


FIG. 4.—Electrocardiogram of the case described showing a conduction defect comparable with the "newer" type of right bundle branch block.

tion, only mild urinary infection which responded to the simplest therapeutic measures) it seems reasonable to suggest an alternative explanation. Her symptoms may be interpreted as due to the development of chronic venous congestion through the late months of pregnancy overtaking a circulation already hampered by a congenital cardiac defect. It is now suggested that consideration of the physical findings indicates a complex defect of which the several components are outlined.

(1) *Coarctation of the Aorta*.—X-ray films taken at two metres show a normal sized ascending aorta, with a rather undersized knuckle, while the remainder of the arch is not visualized. Moreover, Rösler's sign is present. In addition a loud systolic bruit is heard at the aortic cartilage and is conducted into the neck and to the interscapular area posteriorly. The blood-pressure in either arm is markedly raised, and in great excess of that in the lower limbs. The gross difference is in pressure between the two upper limbs noted on admission to hospital, presumably with a reduced cardiac reserve, when the left brachial exceeded the right by some 50 millimetres of mercury, is explainable by the coarctation being situated just distal to the entry of the patent ductus to the aorta, from which the great vessels may take an unusual origin.

(2) *Patency of the Ductus Arteriosus* as instanced by the characteristic machinery murmur heard in the second left space and conducted up to the left clavicle. In this case the shunt is predominantly arterio-venous, the patient being acyanotic.

(3) *A ventricular septal defect* is postulated on account of the well marked and separate systolic and diastolic bruits heard inside the apex beat, and the bizarre electrocardiogram comparable with the Wilson type now recognized as indicative of right bundle branch block. Radiological evidence indicated definite enlargement of the right ventricle and of the conus. In Abbott's analysed series of 110 cases of pulmonary stenosis there was a septal defect in 101. On the other hand, in 70 with aortic coarctation of the so-called adult type there were only seven instances.

Cowan and Ritchie (1935) point out that patency of the ductus arteriosus can be first recognized during an illness or, in later life, an examination for military service or life assurance. We have noted four cases of this anomaly in one year in the out-patient department of a military hospital. Similarly, it is of interest to recall that eight of Lewis's nine patients with coarctation of the aorta were Army pensioners. Evans has recognized six different types of coarctation of the aorta, according to the site of the constriction, patency of the ductus arteriosus, and state of the aorta proximal to the constriction. Under this classification, our case would be placed in Type I. Among the eight cases of this type which he described, only one had reached adult life, a man aged 30 in whom necropsy showed wide patency of the ductus with enlargement of the right heart. Where the coarctation occurs at its usual site—distal to the origin of the left subclavian—the radial pulses

are equal. Various observers, including King (1937), Parker and Dry (1938), and Bayley and Holoubek (1940), have noted that the pulses may be unequal, the right being more forceful than the left, and have explained this by a coarctation at or above the origin of the left subclavian artery. In our case, however, the left pulse was more forceful than the right. In the limited review of the literature which we have been able to attempt under present conditions we have only noted two similar cases (King 1926 and East 1932). It is realized that the explanation of the physical findings which we have advanced is a purely hypothetical one, and that the final truth can only be revealed at necropsy.

Our grateful thanks are due to Dr. G. A. Allan for his criticism and to Colonel D. F. Mackenzie, *D.S.O.*, late *R.A.M.C.*, and Colonel R. A. Lennie, *T.D.*, for permission to publish this case.

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SOME POINTS ON BASE HOSPITAL ORGANIZATION (TENTED).

BY COLONEL R. RUTHERFORD,

Officer Commanding a General Hospital.

CHOICE OF SITE.—This is a tactical problem and will be decided by the higher command, with due regard to transport routes such as waterways, railways, roads. The site should be away from military targets and, in the case of a Base Hospital on an island, should be away from any beach that would make a suitable landing for enemy troops, otherwise the Hospital may find itself in the front line. It should be at least 1,000 yards away from troop concentrations, dumps, etc. It should not be near an aerodrome, as the sick and wounded have probably come from areas where they have been harassed by air attack, and the proximity of an aerodrome would be most unsettling and would be a vitiating factor retarding recovery and in some cases probably precipitating, or at best worsening, neurosis.

PREPARATION OF SITE.—If orders are given to open up in a hurry, the digging down of a hospital is ruled out for the time being. The ground must be cleared of all stones and boulders and levelled off where necessary. If this is not done you will find that in a few days the tarpaulin floor coverings have been kicked through where inequalities exist. It is important at the earliest possible moment to dig slit trenches both for patients and Unit personnel. The slit trenches outside marquees are dug at each corner in "dog-leg" pattern with each portion not longer than 6 feet.

If, as is most unlikely, there is unlimited time to lay out the Hospital, all tents can be dug down. To dig down a hospital of any size complete will take about three months. It must also be borne in mind that the digging down of hospital tents is entirely conditioned by the rainfall. It is quite useless to attempt to dig-in tents where this is heavy.

DISTRIBUTION.—The distribution of ward tents and departmental tents is conditioned chiefly by the water supply. It will be frequently found that water is supplied by pipe line and as water pipe line is a scarce commodity a minimum length only will be available; probably about 300 yards for a 600 bedded hospital. It is then essential to lay along this pipe line those services which cannot be run without a near supply of water and these are—Operating Unit, X-ray Unit, Path. Lab. and P.M. Room, Dispensary, Hospital Kitchen, Unit Messes, Regimental Institutes. The wards will be distributed on each side of the Departments so as to facilitate water carriage.

The lighting plant or plants will be laid down where they will serve the load most effectively.

Secondary roads will be made to meet the requirements of the lay-out.

CAMOUFLAGE.—Strictly speaking it should be unnecessary to camouflage a hospital as there is growing evidence that the Red Cross, when seen, is

respected and this, if available, should be laid down at the four corners of the site some 200 yards from the nearest tent. Where the tents issued are of the Hospital Extending Type, the drab colour of the majority of the tents fits in well with most surroundings. E.P.I.P. tents on the other hand are of a dazzling white and before erection should be wetted and plastered with mud or sand. There is a spraying apparatus for the camouflaging of tents but this should not be relied on as it seldom appears. Decorations outside tents should be discouraged as there is a tendency to make them with conspicuous articles which reflect sunlight.

CONCRETED AREAS.—There are certain areas on the site which must be concreted and these are the Operating Unit, Path. Lab. and P.M. Room, stands 12 by 12 feet outside Dining Halls for washing up purposes, kitchens, ablution areas, swill stands, latrines, conservancy stances. With regard to the Operating Unit concreted area, a shallow channel 6 inches wide deepening to $1\frac{1}{2}$ inches in the centre should be made so as to fall within the operating unit when the tent is pitched. The channel is "U" shaped with an outlet at the curve of the "U" leading to a soakpit some feet outside the concrete area. The floor should be gently sloped to this channel. This facilitates swilling down after operations. Whilst the concrete floor is being laid, the tent roof and side poles should be in position and the poles worked gently whilst the cement is hardening so that they do not become embedded. It is also important to introduce the pegs holding the side walls before the cement hardens and clear an area round each peg so as to permit of further driving in if required. This cement base should stretch three feet beyond the side walls and have a concrete path leading off to the sterilizing room and the theatre store room.

Conservancy stances are required if the method of disposal of conservancy is by contractor. There should be more than one for convenience of loading and each stance should be supplied with a water point. The object of these stances is that the lorry taking away the conservancy should be driven on to the stance and all loading of conservancy done on the stance. There should therefore be a wide margin of concrete clear of the actual lorry. When the loading has been done, the stance is swilled down and the resultant dilute sewage flows into a soak pit.

SEMI-PERMANENT BUILDINGS.—There are certain departments in a tented hospital which should be housed in semi-permanent buildings—these are the Operating Unit, X-ray Unit, Path. Unit, kitchens and Steward's Store.

TENTS OR SEMI-PERMANENT BUILDINGS OR MACHINERY REQUIRING SPECIAL PROTECTION.—These are in order of urgency—Telephone Exchange, Theatre, X-ray Unit, Dynamos and Lighting Sets, Path. Unit. If possible the lighting sets should be in a sound-proof structure otherwise there is loss of sleep in nearby wards. The protection should be done by the Engineers as amateur work is dangerous.

TENT PITCHING AND CANVAS MAINTENANCE.—The type of ward unit will depend on the type and amount of canvas available.

Hospital Marquees, Extending.—The ideal construction is two sections of four in parallel with a connecting passage at one end, in the middle of which are two end sections acting as a clinical room, ward kitchen, Sister's Bunk, etc. This type of structure demands six ends for eight sections which is highly uneconomical: or in other words if you use ends in a prodigal fashion you will have none for other purposes such as Administrative Offices. The most practical lay-out is eight sections taking up two ends.

E.P.I.P.—With regard to E.P.I.P. tents there are two alternatives: one is a cruciform arrangement of tents, the other is end to end. The latter is probably the better but it must be remembered that tight lacing is essential. In addition it is best to get some spare canvas strips which are placed under the ends and not as channels to take away any rainwater which comes through.

The tents must be pitched end on to the prevailing wind and care must be taken that main guys are firmly anchored. In sand it must be realized that the wooden posts issued are useless and an early opportunity to draw long steel picketing posts from the Engineers must be taken. If these are not available, an alternative is to dig holes where the main guy stays will be, fill these with cement and before the cement sets a stout wire loop should be embedded. This will help you to ride out any storm, but it must be remembered that the guy ropes should be adequately protected from chafing.

Ward orderlies in tents are instructed that a frequent inspection of guy ropes is most essential and they should loosen and tighten as required, bearing in mind that a damp atmosphere will tighten the guy ropes and pull out the pegs. The ward orderlies should also be instructed that if in their view the situation is beyond their powers the Storm Party should be called out. This Storm Party should be as large as possible and should be organized before pitching is commenced.

There should be a routine tour of all tents one hour before dusk and minor faults can be remedied.

A suitable person, drawn from the Unit if possible, should be detailed for repair of canvas. Much repair work can be obviated by intelligent stowage of stores in tents, bearing in mind that any hard edge, boxes, etc., should be so far away from the walls that a sudden gust of wind will not belly the canvas and cause chafing. This should be particularly remembered when erecting racks in the Pack Store. The tops of the racks must clear the tent roof under any circumstances of storm and, to make doubly certain, any hard corner should be protected by old socks.

WARD DISTRIBUTION.—The clinical units must be regarded as fluid. For convenience of supply there will be a clinical unit on each side of the water pipe line but this cannot be regarded as strictly medical on one side and strictly surgical on the other. The distribution of patients in these units is entirely subservient to the military situation and the disease or diseases that may be endemic or prevalent at the time.

Again, there must not be too much pre-allocation within the Divisions, i.e. it would be ideal to have on the medical side separate wards for malaria, dysentery, acute medical cases, diphtheria, tonsillitis, sandfly fevers, gastric cases, catarrhal jaundice, etc. It is only practical to cater for clinical groups such as malaria, dysentery, typhoid, isolation. Otherwise it would be found that on reception of a large convoy your maximum number of tents would be occupied by the minimum number of patients. The same applies to a lesser extent on the surgical side.

The various clinical sub-units on the medical side require separate consideration, e.g. the Dysentery unit requires fly-proof bedpan cabinets and a small incinerator for disposal of fæces and dysentery pads. The Typhoid unit requires separate utensils for each patient, a special technique for dealing with bedpans and soiled bed-linen and disposal of fæces. Malarial patients must sleep under nets.

On the surgical side a fracture ward should be near the X-ray Department. There should be a clean surgical unit, a septic surgical unit, a unit for desert sores and a unit for E.N.T. and Eyes. With regard to the latter two special departments, it must be realized that one Sister cannot do justice to both these departments, however small. It is a most unusual combination to have a Sister experienced in these two specialities.

CARE OF STORES AND EQUIPMENT.—This is a problem which requires the most minute attention from the time of formation of the Unit. Stores are apt to go astray in transit and provision must be made for guarding these stores, taking care that written instructions are given to the Officer in charge of the party. He should insist on being present at the loading and unloading of these stores and should check any tendency to careless handling. If the stores travel by a different train or ship, the O.C. should insist that a party accompany the stores, unless higher authority directs otherwise. When stores arrive on the site they must immediately be checked on opening the containers and it is at this stage that an eye must be kept on a future move; i.e. packing cases must be jealously guarded. This is done by careful opening and any unavoidable damage being repaired as soon as the case is empty. The cases are then stored and strict instructions are given that they must on no account be touched as there may be a tendency to use them for firewood. This cannot be too strongly stressed as, if the unit is ordered to move, the packing cases will be required to repack the stores. If the packing cases have been destroyed, your move will be completed at the expense of about 50 per cent of your stores.

There should be proper taking over of ward equipment by the Matron and she will see that it is properly taken over by sisters in charge of wards and departments, keeping an eagle eye on any subsequent handover when a Sister goes sick, goes on leave or is posted to another unit. The Quartermaster will make frequent inspections of equipment and see that the stocks held tally with those entered on the Inventory Boards. It should be borne in mind that Red Cross stores must also be accounted for and shown on a separate Inventory Board.

Borrowing.—In departments such as the theatre borrowing cannot be avoided. The Theatre Sister must keep a book in which the article borrowed is entered and a signature taken from the person borrowing.

Care of Breakable Items.—There are two items in a tented hospital which are particularly liable to be broken: thermometers and syringes. Thermometers should be carried on the person of the sister in charge of the ward and put in sterilizing fluid when not being used. Immediately they are used the sister takes charge of them again. If thermometers are kept in a jar the flapping of the tent sides in a breeze will upset the table on which they are standing and these thermometers will be written off!

With regard to Record syringes the chief delinquents are Medical Officers. They use the syringe for aspirating blood, pus, etc., and, as soon as they have withdrawn the fluid, the syringe is put on one side without removing the plunger. In a few minutes the plunger becomes irretrievably fixed, force is used to remove it and the syringe breaks. The excuse given—"faulty syringe!"

Much of this syringe breakage can be prevented at the outset by circulating to all concerned minute but simple instructions on the care of syringes on the following lines.

- (1) When you have used the syringe draw water through the needle and wash out.
- (2) Remove the plunger and needle and place in cold water.
- (3) Clean the syringe, remove all visible trace of pus or blood, wrap each part in lint or pieces of linen and boil.
- (4) Never boil a syringe with the piston in situ.
- (5) Never put a hot syringe into water to cool.
- (6) Store the syringe in a box, preferably on the ground. If syringes are left on tables these are sometimes blown over.

Breakage Forms.—You must insist that when an item is broken, the breakage form is submitted to the Quartermaster forthwith and to the C.O. within twenty-four hours. If the rendering of breakage forms is slack, it is found that on perusal the excuse is insufficient and, when asked to interview the individual, you are told that he or she has been posted to another unit, gone on leave, etc., and the mystery is never cleared up. A Court of Inquiry has to be held and there is a drain on unit funds.

With regard to non-occupied wards, the equipment should be withdrawn at once and in any case should not remain there overnight. If this is not done the equipment disappears.

All store tents must be slept in. If this is not done the stores disappear.

SANITATION.—The type of latrine adopted will depend on the nature of the soil. The ideal type would be the deep trench latrine and it will be found that these can be conveniently used by patients who are convalescent. Sanitary annexes must be provided for patients who cannot walk very far. These will be constructed a few yards away from the wards and will be of the bucket type. Whatever type is used must be fly-proof. In order to save

material the policy has been adopted that it is the bucket that should be fly-proof and not the whole annexe, except for departments where fly-borne diseases such as dysentery, typhoid and cholera are treated, where an effort must be made to attain complete fly-proofing.

In the absence of a contract for disposal of conservancy, incinerators must be provided. Close collaboration with the hygiene authority and the engineers should result in the construction of an efficient installation.

Swill.—All swill buckets should be on a concrete base which can be washed down and kept clean, the washings going into a soak pit. The ideal is a concrete base 14 by 8 feet, half of which has a semi-permanent building erected, open under the eaves for about 6 inches and there wire-netted. The other 7 feet should be enclosed entirely in wire netting and have a door. The swill buckets are housed inside the small building, swill proper on one side and dry refuse on the other, distinctly marked. The door should be self-closing. This prevents the swill area from being rifled by jackals and cats. If the wire netting is white-washed it acts as a deterrent to the passage of flies.

All soak pits should be fitted with covers and have a fly trap in the lid.

Bed-pan Stances.—All bed-pans, except those for fly-borne diseases, should be stored on the sunny side of the annexe. A pit two feet deep is dug along the annexe, filled with stones above ground level, the stone surface being slightly sloped away from the annexe. After cleaning, the bed-pans are laid on these stones and the heat of the sun bakes them and keeps them germ-free. (This of course would only apply to tropical and subtropical areas.)

Anti-Fly Measures.—It is best to appoint an officer to run an anti-fly campaign and to put a hut at his disposal for storing supplies such as Flit, Flit Guns, Tanglefoot, fly traps and material for repairing fly traps. Posters should be freely displayed and 100 per cent of fly swats should be issued to all ranks. This includes patients who are fit to use them. During the fly season it should be insisted that all ranks carry a fly swat when compatible with duty. Lectures should be given by this Officer on the conditions which favour the breeding of flies and how these conditions can to a large extent be eliminated. All precautions must be taken against your site becoming a breeding ground for mosquitoes.

Stoving of Bedding.—It is important that bedding requiring disinfection or disinfestation should be removed at once. Steps should be taken from the beginning to see that responsibility for removal is clearly allocated and understood. Disciplinary action should be taken on the slightest infringement.

UNIT MATTERS.—Unit accommodation will usually be at the periphery of the Hospital. The Nursing Sisters should be accommodated in a protected enclosure. This is a very reassuring factor and is not advanced as a necessity.

Where Contractors are allowed, their goods, prices and contracts should

be rigidly scrutinized and they should be made to contribute to the Regimental funds. Their sanitary arrangements should be frequently looked into and their living tents also visited frequently. Unless this is done you find fly breeding is extensive in their vicinity.

It is essential to appoint a Sports Officer and to see that the men have sufficient recreation. Inter-unit fixtures should be arranged.

The Unit Padres will organize concerts, cinema shows and so forth.

OPERATING UNIT.—If possible this should be a semi-permanent building and should comprise theatre proper, plaster room, sterilizing room and theatre storeroom. If the Unit is in a tent there should be an open space between the theatre itself and the plaster room. The plaster room should be used for minor and septic surgery.

The sterilizing room should be fireproof with sterilizer on one side and a fireproof bench on the other for boiling up sterile water and for housing a still for distilled water. Water should be laid on. A shelf can be made under the fireproof bench for storing drums, sufficient clearance being left underneath for swilling down.

With regard to lighting, a good operating light can be constructed from petrol tins used as reflectors and can be made almost shadowless by skilfully placed bulbs. There is an emergency lighting set composed of acetylene lamps.

Operation lists are issued to interested personnel, not forgetting the ward from which the patient is brought.

Surgical Teams.—You may be asked to arrange for a Surgical Team to be detailed and to proceed when and where required. You must find out if the team will be proceeding to all operation facilities or whether it is expected that all equipment should be taken with them, and arrange accordingly, bearing in mind that, if you are expected to supply instruments for such a team, you must indent for them so that they are in readiness. In this event you will also arrange for sterilized dressing to be constantly on hand and your officer in charge of Surgical Division will be responsible for keeping all equipment to the required scale, not forgetting that dressings will require to be periodically re-sterilized.

Sterilizing.—The field sterilizer is usually of the Manlove Alliot pattern and is shipped in a stout packing case. When the packing case is undone you will probably find that the retaining braces inside have been smashed and the sterilizer itself will probably require extensive repair, such as rewelding of shorn off cocks and reshaping of outer jacket. This will be done by the Engineers and the apparatus tested out by them to ensure safety. Before it can be used it will require a metal chimney to be fixed of a sufficient length to clear the roof of your sterilizing room.

You will require to organize times for sterilizing of drums bearing in mind that the capacity of your sterilizer is limited (two large drums and one small or five small drums). It must be insisted on that all drums have metal identity tallies cut out from old tins and symbols marked by nail indentations.

Adhesive plaster must on no account be used as it is wasteful, unsightly and ineffective.

Sterilizing Control.—The sterilizer must be tested weekly by plating dressings after sterilization. A sterilizing technique must be evolved to suit existing local conditions, e.g. flies and dust. The ideal, of course, would be a fly- and dust-proof operating theatre: this cannot be achieved.

The following series of experiments were carried out and on the findings a suitable technique can be laid down.

Experiment 1. Plating dressing straight from drum. Result—sterile.

This proves the efficiency of your sterilizer.

2. Plating sterile dressing after standing uncovered for one hour. Result—growth of pathogenic organisms, proving air- or fly-borne contamination.
3. Dip a fly in ink, allow it to crawl over sterile dressing and plate the track. Result—growth of pathogenic organisms, proving that the fly is a contaminator.
4. Plating of same fly. Result—growth of same organisms as in last experiment. Proof as above.
5. Plating of dressing wrung out of 1: 1,000 perchloride of mercury solution, after standing for one hour. Result—sterile. Proof that perchloride of mercury is an efficient germicide.
6. Plating of sterile dressing soaked in 1: 1,000 perchloride of mercury after fly dipped in ink allowed to contaminate. Result—sterile. Proof as in Experiment 5.
7. Plating of same fly. Result—growth of pathogenic organisms.
8. Plating of sterile dressing after standing one hour, but covered with sterile towel. Result—sterile, proving that adequate protection excludes contamination.

Conclusions. It would seem that the covering of dressings is sufficient but it must be borne in mind that a certain time elapses between the extraction of a swab from under a sterile towel to the time the swab is placed on the wound. During that time it may be contaminated by pathogenic organisms which are dust-borne or fly-borne, therefore the added precaution of wringing the dressing out of 1: 1,000 perchloride of mercury solution is essential and this technique was adopted with success during a period of seven months in a desert area. In spite of this it was decided never to open joints. These cases can be quite well dealt with in Hospitals that are housed in buildings where the staff can practise complete aseptic technique.

OUT-PATIENT DEPARTMENT.—In a tented hospital that can be quite easily run by the Theatre Staff and should be in an adjacent tent. This is a saving in personnel and equipment.

PATHOLOGICAL LABORATORY.—It is stressed that this should be in a semi-

permanent building and that the media room should, as far as possible, be rendered dust proof. Otherwise the impalpable dust in the air will find its way even into Petri dishes. There should be a fly-proof bedpan cabinet with a capacity of about 20 bedpans for a 600 bedded hospital. Stress should be laid on the proper wording of requests for examinations by Medical Officers.

MESSAGE DEPARTMENT.—This should normally be attached to the X-ray building and in addition to the equipment laid down the Engineers should be asked to instal a rib stalls and pulley system for limb exercising. With regard to the staffing of this establishment, it is essential that the M.O. in charge should have a real interest as well as experience in the work. Otherwise the Department becomes a dead end, requests for massage by M.O.s are never intelligently challenged and the attendances become so numerous that cases actually requiring physio-therapeutic measures are by no means adequately dealt with.

Progress charts should be kept showing reactions of muscles and nerves and a column for remarks, noting general improvement or otherwise.

Depending on local facilities, occupational therapy may be practised and some form of this useful measure should always be visualized.

DISPENSARY. Storage Inflammables.—Ether and other inflammable material must not be stored in the Dispensary. A hole should be dug and suitably covered.

Ether must on no account be stored in wards, and an order to this effect should be incorporated in Standing Orders. If an operation requires to be done in a ward the Anæsthetist will bring his own apparatus.

Dispensary Books must be scrutinized once a week by the O.C. and apparent extravagances checked. The Dangerous Drug Book is similarly scrutinized.

The Dispenser on duty will be detailed daily to meet with necessary requirements at all times.

A weekly dressing expenditure is kept for all wards. This is checked weekly and any abnormal items investigated.

RECORD KEEPING. In the Divisional Offices.—A Record Card Index System on 5 by 3 cards must be instituted at once. The method is as follows:—

(a) *The Key Book.*—This is a book with consecutive numbers from 1 upwards. Against each number is placed the name of the admitted patient as he arrives. This number has nothing to do with the number in the A. & D. Book but is a sequential number of patients admitted to the Division.

(b) *The Record Card.*—This is made out by the Wardmaster on the admission of a patient and on the front of it is entered (i) the sequential number in the Key Book, (ii) Regimental Details. A space is left at the bottom for diagnosis. The card is completed on the discharge of the patient by the Officer in charge of Division entering (i) Disposal of the patient, (ii) Any relevant clinical details, with particular attention to noti-

fiable diseases and accidental injuries. These cards are filed in alphabetical order.

(c) *Disease Index*.—An extract is made from "The Nomenclature of Diseases" of those diseases and injuries likely to be met with in war. This list is kept on loose leaf foolscap, taking care to space the diseases in such a manner that the commoner diseases and injuries will have an adequate blank space for use. On the discharge of a patient his Key Book number is entered under the disease from which he is suffering.

The advantages of this system are too obvious to require detailed explanation. Suffice it to say that any extra-hospital inquiry can be answered in a few minutes: you can tell at a glance at your Key Book your admissions to a certain date: by consulting your disease index you can at once see the nature of your work: you can provide useful clinical information by a study of the clinical findings on the record cards.

At the end of the year the whole system is parcelled up and the same system adopted for the following year.

In Special Departments.—Patients sent up for consultation should be recorded by the Specialist concerned on 7 by 5 cards.

HOSPITAL OUTPUT.—The functions of a hospital are to receive sick and wounded and to return them as quickly as possible either fit to their unit, convalescent, boarded to another category, or invalided. The speed at which this is done must of course be commensurate with efficient treatment.

The output of a hospital can be materially speeded up only if the patient is conscientiously supervised. All patients who have been out of bed for one week should be seen by the O.C., the appropriate Specialist or Medical Officer being in attendance at the same time. By this means it can be seen whether the facilities of the hospital are being used to their full extent and it must be insisted on that the patients doing ward duties will also attend.

BOARD PROCEDURE.—A well defined procedure must be laid down from the beginning. The following sequence is suggested:—

- (1) M.O. in charge of case reports to appropriate Specialist, suggesting Board:

- (2) If Specialist concurs, the requisite board papers are prepared, the Specialist adding his report, and the papers, together with X-ray films, I.1220, and Path. Reports are submitted to Divisional Officer for perusal, approval and handing to Chief Clerk.

- (3) The Chief Clerk prepares the requisite copies and the patient is brought before the next medical board.

If a Standing Medical Board is appointed to consider all cases, this should assemble at intervals of not more than one week at each Hospital. Longer periods are wasteful of Hospital beds as, in many cases, immediately the patient has appeared before the board he can be sent to a Convalescent Depot to await approval and subsequent evacuation.

A Register should be kept by the Chief Clerk in which the patients' details are entered as soon as the documents are first submitted, with the date. The headings should show date of Board, date of submission to Approving Authority, date of approval, disposal and remarks. A copy of this Register, showing only those cases awaiting Board, awaiting approval or awaiting evacuation in Hospital, should be prepared and kept up to date in the O.C.s Office.

A separate register should be kept of "Regradings" and "Evacuations" and the Regradings Register (including those placed in Category "C") should show the date of notification of Unit of the regrading and the *exact* disposal of the patient, as it is found that Units raise many queries on this point. Patients should not be brought before a board for regrading until they are fit for discharge to duty within the scope of their new grade, and the Chief Clerk should periodically look through the Register and by checking with the A. & D. Book mark all patients discharged. The attention of the Divisional Officer should be drawn to any who are not so discharged.

The fact that the C.O. sees all up-patients once a week is a double check to see that cases put up for board are boarded, as he can check the exact state from the register kept in his Office and take any action he thinks necessary if there is a hold-up.

If this is not done you will find that patients hang on interminably in hospital and any inquiries as to their fate will be fobbed off by the formula—"waiting for a board"!

FIRE DISCIPLINE.—A Fire Officer should be appointed and his duties may well be associated with those of P.A.D. Officer. He should give frequent lectures and hold frequent fire drills. A Fire Picquet will be detailed. In wards there should be adequate and visible notices pointing out the dangers of carelessly thrown cigarette ends: it must be borne in mind that notices may have to be provided in appropriate languages. Ash trays should be provided on every locker. Night orderlies must be strictly warned that there must be no unattended lights in the tents: a sudden storm may blow up and a lamp being upset is likely to cause a fire.

In Stores—no smoking to be allowed.

In Personnel Lines—Officers are the chief offenders and a watch should be kept for unattended lights, particularly during the evening meal.

TELEPHONE DISTRIBUTION.—It is considered that twelve instruments are the irreducible minimum for a General Hospital, however small. These are based on essential Departments, the remainder supplying ward groups: the more acute wards acting as the centre of each group.

P.A.D.—A P.A.D. Officer will be appointed and should make close liaison with the Area P.A.D. Officer, so that his scheme fits in as closely as possible with Area requirements. He will see that slit trenches are made on an adequate scale for patients and personnel. During an air raid he will be in the command post which is usually the telephone exchange. Suit-

able places on the site are selected for spotting posts—these should be in communication with the Command Post by runners (two runners to each post). The O.C. should be in the Command Post, the Surgeon on duty in the theatre, Officer in charge Surgical Division is in touch with theatre, Surgical Wards and Command Post, and Officer in charge Medical Division is in touch with Medical Wards and Command Post.

Procedure at Night.—Personnel not on duty stay put unless the “fall in” sounds.

Procedure in Daylight.—Routine work not interfered with unless actually bombed. Provision should be made for the dispersion and protection of motor transport. Convenient hillocks can be partially dug out and the vehicles run in.

SECURITY.—All natives employed on the site must have passes in order and all persons should be challenged and have their passes scrutinized. If you see a native carrying a bag, get him to open it—it usually contains items pilfered in the unit area. Unauthorized persons should be discouraged from passing through unit lines, otherwise items of equipment and personal belongings will be missing.

SECRET DOCUMENTS.—Greatest care must be taken of all such documents and it should be ensured that they are not left lying in officers' tents. A distribution book must be kept and it is the duty of the Chief Clerk to see that all such documents are under lock and key.

MONEY.—Money should not be allowed to accumulate but should be paid into the bank at frequent intervals. This applies to all Messes.

STANDING ORDERS.—These should be compiled to meet the situation. A set of orders which may be excellent in one situation would be impracticable in another. Patients should be made to sign the appropriate section of Standing Orders as having read them, as soon as they are fit to do so.

PASSES.—Other Rank patients are inspected by the Wardmaster before walking out to see that they are properly dressed.

KITCHEN DISCIPLINE.—All ranks handling food should have a stool examination to exclude the dysenteries and any man handling food who is suffering from diarrhoea must report sick and be removed from duty until the condition is cleared up. Personnel suffering from V.D. are rigidly excluded. The N.C.O. in charge of the Cookhouse should examine the hands and finger nails of his personnel each morning. Nail brushes should be provided. Everyone in the Cookhouse should be fly conscious and all the methods of fly killing and prevention of fly breeding brought into use. All food must be protected. There should be a preparation room, thus preventing soiling of the ground outside with food debris, and one criterion of good kitchen discipline is complete absence of water slopped outside. Grease traps should be well looked after. Smoking is strictly prohibited. If this is not enforced, you will occasionally find a cigarette end embedded in the jam roll!

DINING HALL DISCIPLINE.—All cutlery should be inspected frequently

and food adequately protected. There should be a liberal supply of tangle-foot and fly traps placed where necessary. Posters should be displayed showing that the fly contaminates food and causes dysentery. There should be adequate accommodation for cleaning knife, fork, spoon, plate and mug and if possible all feeding utensils should be scalded as a guard against the spread of diphtheria. All ranks should be made aware of the danger of scattering food on the ground.

SALVAGE.—An Officer or Warrant Officer should be appointed as Officer in charge of Salvage. He must give periodical lectures on what to collect and provide receptacles for the various articles. Each receptacle should have the name of the article collected. He should also point out that any useful articles found on the ground should be returned to the Q.M.'s Stores and on a tented hospital site stray pegs are the chief things one has in mind.

WATER POINT DISCIPLINE.—All water points should be picketed; convalescent patients are suitable for this purpose. The object is to prevent waste of water and to see that ablution benches are used only for that purpose.

POINTS ON INSPECTIONS.—The inspection of a tented hospital should be divided up, doing a section each day, e.g. Medical Division, Surgical Division, Stores, Company Lines. With regard to Divisional inspections, the outside of the tents requires special attention. Slit trenches are scrutinized to see (1) that they are in proper repair and (2) that they are not used as rubbish dumps. *Inside wards*—see that mosquito nets are in proper repair, that all anti-fly precautions are being taken. Inquire into the facilities for keeping meals hot and see that all breakable items are stored in a safe place. *In Sanitary Annexes*—see that all latrine buckets are fly proof and that bed-pans are properly cared for. *Swill Stances*—see that swill buckets are not being interfered with and that debris is not strewn round about. The Sanitary N.C.O. should accompany the C.O. on these inspections. *Butcher's Shop*—see that the meat is properly protected from flies and that the meat is of good quality.

With regard to unit inspection, a prize should be given for the best tent each week. This encourages orderliness. There should be a mosquito net inspection weekly, making an N.C.O. responsible for the inspection of the nets of groups of personnel.

Reception of Convoys.—See that a hot meal is provided and see that the kit of admissions is properly handled: that no more kit than is necessary accompanies the patient into the ward and that the remainder goes into the Pack Store, or to the Disinfector if required. The kit allowed into wards consists of one pair of boots, greatcoat, tin hat, respirator and small kit. If kit other than this is allowed to find its way into the ward it tends to untidiness and articles of uniform will be put on and the patient will go out without a pass and find his way to the wet canteen.

W.3118.—It is most important that this document be perused, not only when the patient comes in on convoy, but immediately his case is reviewed

by the M.O. in Charge. Otherwise important information may be overlooked to the detriment of the patient.

C.O.'s Office Routine.—The C.O.'s day starts with a perusal of the Night Report. He makes notes of any outstanding features. It is advisable that the C.O. should keep a book for making notes for reference to executive Officers, and stroking the items out as they are settled. The Q.M. is then interviewed and outstanding matters dealt with. Discharges should be seen early in the morning, as this prevents patients standing about in the heat of the day. There is a daily consultation with Officers in charge of Divisions and this should take place in the light of the night report and before the day's work starts. The Matron can be seen after she has held her Office.

Duties of Officers in charge of Divisions.—Very little is said on this subject in Regs. for the Medical Services of the Army. It is therefore clear that the intention is that each individual executive officer should formulate his own routine. He is responsible for the proper medical care of the patients in his Division and for discipline in the Division. It is essential that treatment is instituted at the earliest possible moment. This can be ensured by issuing clear instructions to ward staff to call the appropriate M.O. when admissions are received. As in the case of the O.C. the basis of his day is a perusal of the night report and in the light of this he should hold an early daily conference of his M.O.s. This could profitably be done before the O.C.'s conference. The proper administration and discipline in his Division depends largely on the efficiency of his Wardmaster, and one of the chief factors in smooth running is a constant knowledge of the changing bed state. He should insist that reference be made to him before an internal consultation is requested. The Officer in charge Surg. Div. should be a competent surgeon capable of evaluating the work in his division, as he is responsible, as already pointed out, for the proper medical care of his division. He should be in constant touch with practical surgery as he may be called upon to do active work should his specialist staff be depleted, e.g. detachment of Surgical Team.

Finally.—Much important matter has not been discussed as the main intention has been to emphasize the ordinary spade work of moving in and getting snugged down. It is not claimed that any of the opinions put forward are the official view.

THREE RARE CONDITIONS OBSERVED ON BOARD A HOSPITAL SHIP.

BY MAJOR J. C. CAIRD, M.D., F.R.C.P.ED.,
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AND

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EXCEPT when taking on casualties near the scene of action the routine work on a hospital ship is not usually of much professional interest for patients come on board with clinical investigations complete, the diagnosis ready made and in many cases well advanced in convalescence!

It therefore aroused unusual interest to find the three cases recorded here on one shipload of patients transferred from the Middle East.

The cases were:—

- (1) Dwarfism due to pituitary dysfunction.
- (2) Myotonia congenita.
- (3) Transposition of the viscera with dextrocardia.

Circumstances did not permit of much scientific investigation neither were any references available to justify our statements so the case reports are presented with little commentary. We hope our three swans will not appear to others as geese.

Case 1.—Age 21.

Diagnosis.—Pituitary dysfunction.

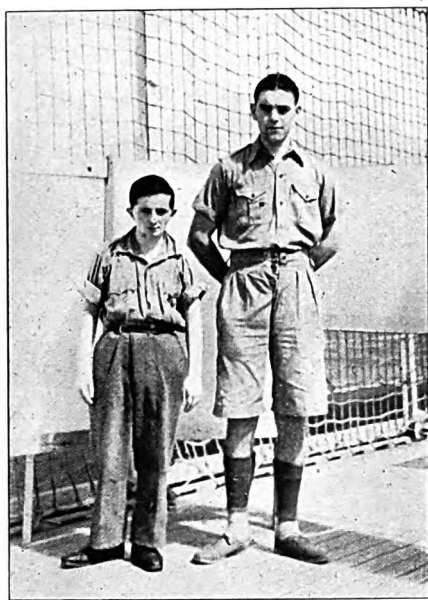
Army History.—The patient served in France in 1940 until June when his unit was evacuated from Marseilles. He stated that by mistake he boarded the wrong ship and was taken to Palestine where he served until March, 1941. He was then recommended for transfer to the United Kingdom by a medical board which found him unfit for service overseas owing to his small stature and the fact that he had been in hospital several times complaining of abdominal pain for which no cause could be found and which was considered to be due to neurosis. Wassermann reaction negative. He was furthermore a bad soldier, had been in trouble on several occasions, and was considered to be mentally dull, irritable and insubordinate.

Patient's Complaint.—Frequency of micturition, pain in the stomach and constipation.

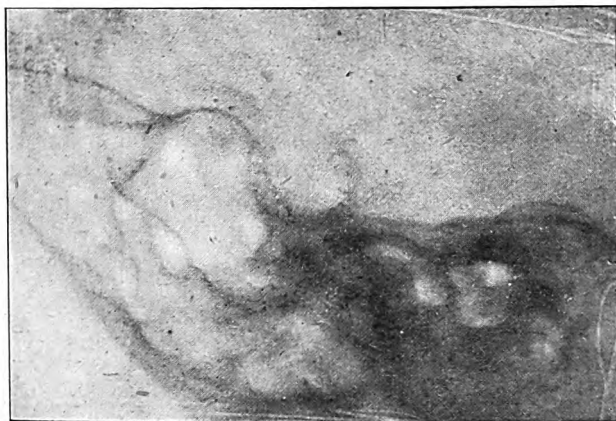
Previous History.—In childhood he had scarlet fever, measles, whooping-cough, and double pneumonia. When 2 years old he underwent operation for right inguinal hernia. At 6 years of age he was in a sanatorium. At 14 he had an appendicectomy, at 17 his coccyx was removed and at 18 he was operated on for double strangulated inguinal hernia.

Examination.—The patient was very small with childish features and

prominent forehead. Weight 7 stone 12 pounds. Height 4 feet 8 inches. Chest 31 inches. Expansion 1 inch. Abdominal circumference $32\frac{1}{2}$ inches. He had a large head, prominent abdomen, short arms and legs and small hands and feet. The skin was fine. There was noticeable



Case 1.—Patient standing beside man 6 feet 0 inches tall.



Case 1.—Radiograph of sella turcica.

adiposity of the abdomen, breasts and buttocks. The pubic hair was of adult male distribution and the body hair and hair of the face were normal though fine and downy. The genitalia were healthy and of adult development. The voice had broken though thin and piping. There were scars on the body corresponding to his rather chequered surgical history. Men-

tally, he was cheerful, self assertive, quick witted in a childish way but irresponsible and unable to sustain concentrated thought. No abnormalities were found in the cardiovascular, respiratory or nervous systems.

Genito-Urinary System: Frequency of micturition. No abnormal constituents were found in the urine.

Abdomen: There was pain and tenderness in the left upper quadrant of the abdomen which could not be elicited when the patient's attention was distracted.

Radiological Examination.—Skull: In the frontal and occipital regions there was an area of bony thickening suggestive of early Paget's disease. The sella turcica was well defined and smaller than normal. There was a faint shadow above and anterior to the sella, suggestive of calcification.

Progress.—A few days after admission to the hospital ship he developed a left-sided lobar pneumonia and pleurisy. Treatment with sulphapyridine was begun but had to be abandoned after a few days' intermittent treatment as he proved to be sensitive to the drug. The leucocyte count which was never higher than 6,000 per c.mm. dropped to 3,000 per c.mm. after twenty-four hours' treatment and rose again when the drug was discontinued. The fall in the count was due to a granular leucopenia. He recovered satisfactorily from the pneumonia but then developed jaundice which cleared up some ten days later.

Family History.—Nothing is known of the grandparents except that they died in old age. He had fifteen uncles and eighteen aunts who are of normal stature excepting one uncle on his father's side who is 6 feet 5 inches tall. His father is 5 feet 2 inches and the mother 5 feet 10 inches. Five sisters seem to be of normal proportions.

Comments.—This is a case of pituitary dysfunction of which the chief features are stunted growth, normal sex development and increased deposition of fat on the abdomen, buttocks and breasts and, as in most cases of pituitary dysfunction, the signs show that there is partial and not complete hypofunction of the anterior lobe. If the assumption be correct that the acidophil cells in the anterior lobe control growth and the basophil cells influence the gonads then, in this case, there is hypofunction of the acidophil cells only. Hypofunction of the acidophil cells may be caused by intra-sellar lesions, supra-sellar lesions and intracranial lesions at a distance. In this case one has to consider the first two causes; for the latter there are neither signs nor history. Supra-sellar lesions are all destructive with consequent depression of the activities of the whole pituitary gland, and the most common is probably the supra-sellar cyst which usually produces the Fröhlich syndrome with abnormal distribution of fat, genital infantilism and sometimes dwarfism. Radiologically there is flattening of the sella-turcica, and distortion or destruction of the clinoid processes. Sometimes the cyst is calcified and can be clearly seen. In the present case the adiposity of the abdomen, breasts and buttocks resemble the Fröhlich type, and a faint shadow above the sella may possibly be a small calcified cyst, but the other features are lacking and on the whole the evidence for a supra-sellar cyst is hardly convincing enough. Intra-sellar tumours will produce symptoms of hypoplasia or a mixture of hyperplasia and hypoplasia according to the elements of the anterior lobe affected and radiography usually shows enlarge-

ment of the sella with attendant pressure on neighbouring structures. In this case no definite cause can be found. A possible explanation may be that in one of the patient's many illnesses in childhood, there was a thrombosis affecting mainly the acidophil cells. It is interesting to note that the patient has a very small father and an unusually tall paternal uncle, but here again the evidence can only give rise to surmise. Unfortunately supervening illnesses made it impossible to investigate this case more fully.

Case 2.—Aged 21.

Diagnosis.—Myotonia congenita.

Army History.—The patient was admitted to a field ambulance at the end of 1940 and was transferred to a general hospital as a possible case of upper motor neuron-lesion. There, a diagnosis of myotonia was made and a medical board recommended him for transfer to the United Kingdom. He was described as mentally dull and quite incapable of his work as a gunner.

Patient's Complaint.—Weakness and stiffness of the hands.

History.—He had suffered from childhood with an affection of both hands which prevented him from relaxing his grip normally, in particular if he had been holding any heavy object or grasping a small object tightly. This disability had been more troublesome since he joined the Army and he had also noticed some muscular weakness on lifting heavy objects. He stated that there had been occasionally a similar stiffness in the legs, particularly on the day following a march of eight miles or more, but he was vague about the onset and duration of these attacks.

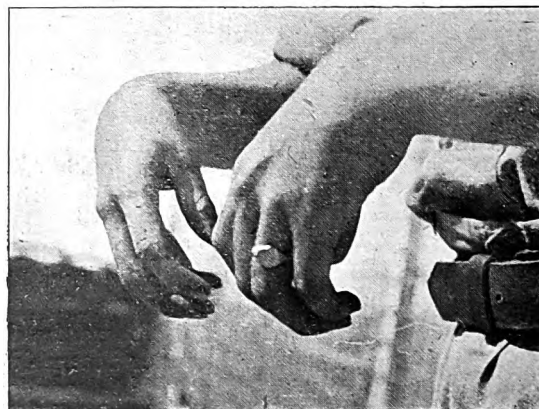
Family History.—The patient gave very little information about his family but stated that his father had been affected by a similar condition since childhood. No other member of the family seems to have been affected. No history of cataract could be elicited.

Examination.—The patient was thin and below average height. Mentally, he was dull, answering questions slowly and unintelligently. He gave a disconnected story of his complaint either because of a poor memory or mental inertia. Muscular development appeared to be normal with the doubtful exception of the hands.

On examining the hands, the small muscles, thenar and hypothenar eminences were rather smaller than normal. The muscles of the forearms and arms were well developed. Muscle power was equal in both hands and the patient had a powerful grip but had some difficulty in lifting a heavy object horizontally, seemingly due to weakness of the extensors of the wrists. After gripping an object firmly there was difficulty of relaxation accompanied by some curious contortions. At first the elbows, wrists and fingers were held in an attitude of flexion. Extension then began in the thumbs and fingers. Before extending the wrists and elbows the digits were slowly flexed and extended at the knuckles in a manner resembling bilateral athetosis. The process of relaxation took about eight seconds and was accompanied by slight pain extending for some three inches above the wrists. The condition remained unaltered after repeated use of the muscles except that the power of the hand grip was slightly lessened. Similar muscular spasm was not elicited in the lower limbs. The myotonic reaction was not obtained from the muscles involved. The reflexes were all present and within the normal range. Apart from the conditions already described no systemic abnormalities were found.

Progress.—Ten grains of quinine hydrochloride were given twice a day for ten days but there was no alteration in the muscular spasm.

Comments.—This was evidently a genuine case of Thomsen's disease although differing from the typical case in that the hands were affected much more than the lower limbs. Although no spasm was seen in the legs there is no reason to doubt the patient's statement that it did sometimes occur especially after the fatigue of a route march. In any case one would be



Case 2.—Thomsen's disease. Showing spasm of hands.

unlikely to see this occasional spasm whilst the patient was on board a hospital ship in the tropics, living under ideal conditions and not exposed to any aggravating factors of cold or hardship. The congenital nature of the disease is suggested by the one definite statement of the family history,

namely that his father suffered from a similar disability from childhood onwards.

A possible alternative diagnosis was myotonia atrophica, a condition in which there is marked inability to relax the flexor muscles after grasping strongly with the hands. But myotonia atrophica manifests itself later in life; there is atrophy of the muscles of the forearms and hands, facial and tongue muscles besides certain of the muscles in the lower limbs. There is also a familiar history of cataract. Mention has been made of some wasting of the small muscles of the hands in this case but if really present this was so slight that it was probably due to lack of use and not to any pathological process. For a diagnosis of myotonia atrophica then the essential signs of muscular atrophy were lacking although in this case there was a superficial resemblance. It is recorded that more or less mental impairment may be associated with Thomsen's disease.

Case 3.—Aged 25.

Diagnosis.—Peptic ulcer and transposition of the viscera.

Army History.—The patient had been under treatment for a persistent peptic ulcer for over three months and had been recommended for transfer home by a medical board.

Patient's Complaint.—Indigestion.

Previous History.—Epigastric pain and heartburn coming on after food during the past four months. Otherwise there was nothing of interest.

Examination.—The patient was a well developed man of average height.

Abdomen: There was tenderness in the epigastrium. On percussion stomach resonance was present on the right side and liver dullness on the left down to the rib border. The spleen was not palpable but, so far as could be made out by percussion, was on the right side.

Chest: The apex beat of the heart was on the right side in the fifth rib interspace just inside the mid-clavicular line. Although not very noticeable it was easily identified. The heart sounds were closed and pure. The pulse rate was 80 per minute, regular in time and force.

Apart from the conditions noted no abnormalities were found. The patient was right-handed.

Radiological Examination.—On screening and in a film the heart was seen lying with the apex to the right. A gas bubble could be seen in the stomach below the right rib border and the liver shadow on the left.

Comments.—This was an everyday case of peptic ulcer and the interest lies in the transposition of the viscera and dextrocardia. The patient had been seven years in the Army and had enjoyed good health until the peptic ulcer developed. He said that he had been aware of the dextrocardia for some five years (he was, in fact, very proud of it) and so far as he knew there were no other cases in the family.

We are indebted to Colonel Edwards, C.M.G., D.D.M.S., and Lieutenant-Colonel Greaves, D.S.O., M.C., for permission to publish these case reports. We also wish to thank Lieutenant R. H. Jones and Corporal McCurdie for the photographs.

Editorial.

REPORT OF THE LISTER INSTITUTE.

THE Report of the Governing Body of the Lister Institute of Preventive Medicine, the forty-eighth report, was presented on June 26, 1942, and is a most valuable and interesting document reflecting the greatest credit on the Director, Professor Sir John C. G. Ledingham, C.M.G., M.B., F.R.S., and his staff. The latter is still very much broken up as regards accommodation, the Division of Nutrition remaining at Cambridge as also Dr. Muriel Robertson and others, while Dr. Korenchevsky and his assistant continue at Oxford and Dr. Zilva at the East Malling Research Station. Much work goes on, however, at the Lister Institute and all the officers, scattered though they may be through the continued necessities of evacuation, are still held in close touch by the nature of their work. Very valuable research work is being recorded, much of immediate importance and some to be still further examined and reduced to its practical application when the war is over.

Dr. A. Felix is devoting attention to the Vi agglutination test and the employment to Vi phase typing in the epidemiological control of paratyphoid B fever. This test for the detection of chronic typhoid carriers and for the typing of typhoid bacilli with the Vi bacteriophage has proved extremely useful since Craigie and Yen described their technique. Most of the chronic paratyphoid B carriers so far examined prove to give a positive B Vi agglutination reaction but, as the Report says, "it is too early to state whether its frequency in paratyphoid B is as high as the T Vi reaction in typhoid carriers."

In the typing of paratyphoid B bacilli with the Vi bacteriophage, Dr. Felix and Miss Callow have examined over 600 cultures. Bacteriophages were grown from paratyphoid B patients and carriers and from lysogenic "rough" variants derived from these cases. While most of the phages thus obtained were O phages, a smaller number of Vi phages were found which acted selectively on certain strains of paratyphoid B but failed to lyse other strains. "Some of the Vi phages have been trained to develop strain specificity while this has not been accomplished in the case of any of the O phages so far examined. When such adapted Vi phages were tested against strains from different localities it was found that the strains could be divided according to their response to different phage preparations and that strains from the same outbreak reacted in an identical manner." Much may be expected from this work.

Since the publication of their work on the capacity for toxin production of *Cl. welchii* strains from war wounds and air-raid casualties, Dr. Muriel

Robertson and Mr. J. Keppie have continued to investigate this subject at Cambridge. Methods based on the egg-yolk reaction have since been evolved and strains of the organism are being reviewed in the light of their test. "A considerable purification of the factor which promotes toxin production has already been achieved." Dr. M. G. Macfarlane and Dr. Knight have carried out investigations on *Cl. welchii* toxins, amongst others, from a fresh angle and have found that these contain an enzyme which decomposes lecithin into phosphocolin and a diglyceride. Though certain snake venoms are known to contain lecithinase, this type, from *Cl. welchii* toxin, has not previously been described. "It is probable that this lecithinase is identical with the α -toxin in which is the lethal, hæmolytic and necrotic substance predominant in the culture filtrates of *Cl. welchii*, Type A, one of the causative organisms of gas gangrene in man."

Dr. Muriel Robertson has also been working at the agglutination of *Trichomonas fetus* and other trichomonads by sera from vaccinated rabbits and has published a paper on this subject which may well be of considerable importance. The serological study of this type of agglutination has been taken up with Mr. W. R. Kerr of the Ministry of Agriculture, Northern Ireland. The results of the test in the investigation of 165 cattle are set forth in a recent publication and the procedure is found to give a clear indication of the presence of *Tr. fetus* infection in certain types of case. Drs. W. T. J. Morgan and S. M. Partridge are still going on with their studies of the somatic antigen complex of *Bact. dysenteriae* (Shiga) which should, when they are completed, be of great service to officers of the R.A.M.C. charged with the treatment of such cases.

Another investigation which may yet prove of use to our Service is that of Dr. A. S. McFarlane on the removal of lipoids from transfusion plasma. "The technique described in last year's report for removing lipoids from serum by freezing with ether has now been adopted for a trial period by the Medical Research Council Emergency Blood Transfusion Service and quantities of fifty litres of plasma per week are being processed." A great thing in this process of ether freezing is that it also removes the fibrin from the plasma which means that the trouble due to post-filtration clotting of citrated human plasma is likely to disappear. (In this connexion the recent article by Quartermaster Serjeant S. R. M. Bushby and Brigadier L. E. H. Whitby, *C.V.O.*, *M.C.*, in the June number of this Journal describes another method of attaining the same end.) We have recently seen the ether method in action and we were much impressed with the beautifully clear non-clotting plasma produced. We also saw the new method of drying milk and other substances from the frozen state which is now the subject of a provisional patent application. "The milk is first frozen on a metal coil and dried *in vacuo* from the surface of the coil. The heat required to permit evaporation of the water from the surface of the coil is derived from the condensation of the hot gas of the refrigerator." It would appear that McFarlane has, with the collaboration of Professor

H. D. Kay and Dr. Norman Wright, arrived at a process which will be of the greatest use, especially when the present strained state of production of machinery passes over with the war. We much regret that considerations of space oblige us to terminate our Editorial at this point and that, more especially, the portion of the Report dealing with vitamins has to be left untouched but we warmly recommend to the notice of our readers the notes on the "Investigations of Wheat Flours" and on the "Nutritive Value of Protein and other Nitrogenous Constituents in the Potato" which are of the highest interest and value.



Clinical and other Notes.

CAISSON DISEASE.

BY CAPTAIN W. D. ALLAN,
Royal Army Medical Corps.

At the present time when the use of compressed air by the R.E. may at any time be necessary and any Medical Officer may find himself faced with the task of treating cases of Caisson or Compressed Air Disease, I thought that a brief statement of my experiences in the prevention and treatment of this condition might be of more than usual interest.

To most Medical Officers the condition is merely a name, as it is a disease seldom met with, occurring only during the laying of foundations, tunnelling operations, etc., and the contractors conducting these operations often have their own Medical Officer to superintend. Naval Surgeons are, of course, more familiar with the condition, as it occurs during diving exercises.

Tunnelling is a fairly simple process when it is through rock, chalk or any material which will not "fall-in," but when the Engineer has to drive his tunnel straight on, through running water and sand, he is faced with a very different and most difficult problem. He is then forced to have recourse to the use of "compressed air," in order to hold the walls of his excavation together, until such time as his workmen can construct the necessary retaining walls. This of course, makes the construction proceed very slowly and the danger of collapse has to be constantly guarded against as it means loss of life as well as loss of time and money.

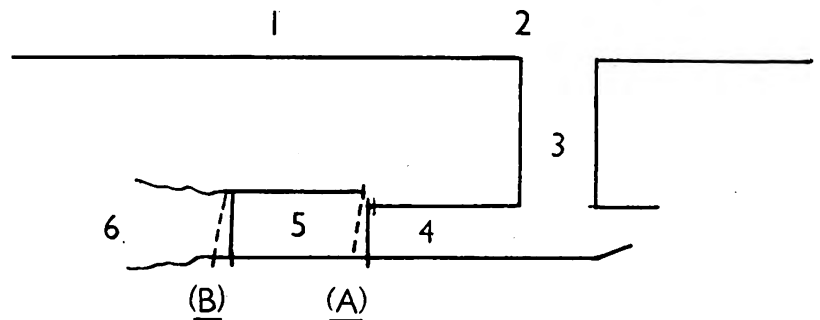
I would here pay tribute to my ex-employers, Sir Robert McAlpine and Sons, and to their staff, as they spared neither time nor money in order to ensure the maximum of safety for all their employees engaged in the construction of this particular sewer. The type of ground encountered was most difficult as a great deal of running sand and water was met with.

In order that one may appreciate the causation and symptoms of the disease, a brief description of the apparatus used by the Engineers and the expense and labour involved in its construction would seem to be expedient. Although I know full well that Editors in general do not look kindly upon the incorporation of diagrams in any article, I would crave the indulgence of ours in particular for his permission to insert a simple one.

It might be of interest at this point to give some idea of one's sensations on being compressed and decompressed, as this may be of assistance to an M.O. or to an Engineer in his choosing of suitable personnel. The

"nervous type," no matter how physically fit he may be, is quite unsuitable for this work.

On entering the air-lock, where one has usually to crouch in discomfort, with the doors closed as shown in the diagram, one's first sensation is one of fear or as nearly that as not to matter. Compressed air is now allowed to enter steadily into the chamber, slowly at first but later increasing in volume until the desired pressure is reached. On being compressed one should chew a sweet which causes salivation and consequent swallowing, or forcibly blow one's nose as doing this helps to allow the air to enter the Eustachian tubes and so aids the equalization of pressure on both sides of the tympanic membrane. Until this takes place one has a very painful and boring sensation in the ears, but afterwards one is quite comfortable.



1, Ground level. 2, Entrance to shaft. 3, Shaft of varying depth, which may or may not require to be air-locked. 4, Completed portion of tunnel. 5, Steel air-lock. (Note that door (A) opens inwards while door (B) opens outwards.) 6, Working face. (Here pressure has to be kept sufficiently high to prevent walls from collapsing.) The pressure in the air-lock must be the same as that in the working-face before door (B) can be opened, and of the same pressure as that in shaft before door (A) can be opened. This means that all personnel as well as all materials must be compressed on entering lock on way to working-face, and decompressed before leaving lock to proceed to the surface.

On being decompressed, which never should be hurried, the feeling is simply one of chilliness, varying in degree with the length of time one has been confined in the compressed area.

In choosing men for this work, I have found it sound not to be guided too much by the ordinary standards of physical fitness, as a raised blood-pressure, some slight cardiac involvements, etc., are of no consequence as long as they are within reasonable limits and the workman has the proper temperament. It is well known to Contractors that certain men will always follow dangerous employment, because of the very high rate of wages, and these men if reasonably fit can always be satisfactorily employed, as they have no fear, being familiar with the type of work. This absence of fear is a very important factor. Men suffering from bronchitis, head-colds, and ear conditions are always unsuitable, while varicose veins certainly predispose to attacks of "bends" as the condition is called by the men.

Causation of Caisson Disease.—The real cause is always too rapid decompression.

Exciting Causes.—(1) Overlong working hours. (2) Very high pressure of compressed air sometimes required. (3) Amount of danger involved (this is an important factor even with experienced men). (4) Type of soil being worked.

The mechanism of the condition is simply the fact that gases dissolve in the blood according to the pressure, so that when one is compressed the nitrogen is forced in from the tissues and is dissolved in the blood. It is estimated that at a pressure of 20 pounds per square inch the blood contains four times its normal nitrogen. The 20 pounds is, of course, 20 plus the normal atmospheric pressure of roughly 15.

When one is decompressed slowly, it gives time for the nitrogen to be re-absorbed by the tissues, but when decompression is too fast the tissues cannot absorb the gas quickly enough and it therefore circulates in the blood-stream as very small bubbles of nitrogen, really gas emboli. The best example of the action is seen in the opening of a bottle of soda water. When the stopper is in situ, the contents of the bottle are still, but immediately the stopper is removed and the pressure relieved brisk effervescence occurs. Sooner or later one or more of the emboli will come to a small vessel—too small to allow it to pass—and the result is an attack of the “bends” or Caisson disease.

It cannot be too strongly stressed that one, when fixing length of working hours and the decompression times, should err on the safe side. When however one gets to know his men, etc., he may if the occasion arises take a chance without much danger. Personally I have repeatedly been decompressed in a fraction of the proper time with little bad effect but, of course, I had only been compressed long enough to attend to my medical duties.

When men are working in pressures of under 20 pounds they can safely be allowed to work a six to eight hours' shift and require a decompression period of only about forty to fifty minutes in the air-lock before surfacing. When, however, the working pressure is over 20 pounds the working hours must be shortened and the period of decompression lengthened and, even when all precautions are taken, casualties will result.

This 20 pounds “danger point” perhaps sounds peculiar but I have repeatedly noted it to be a fact as have many of the engineers with whom I have worked. It is a sound rule to prepare for trouble when the pressure exceeds 20 pounds.

Many other factors come into play, such as the use of oxy-acetylene or other metal cutting plant in confined spaces, but these have to be considered individually.

Symptoms.—The symptoms are dramatic in onset and in kind. Usually in about thirty to sixty minutes after the man has left the air-lock he is suddenly taken ill with violent pain. This pain is very often about the flexures

of the knees or elbows, but of course may occur at any other site, most commonly in the chest. The pain is really of great severity, and the patient will writhe and twist in a truly alarming fashion shouting loudly for help. If the pain is in the chest, spitting of blood usually occurs. Fortunately the cerebral blood-vessels are not very often affected and, in a group of about a hundred cases, I have only once seen a case of cerebral embolism. In this case, fortunately, the medical air-lock was quickly available and the condition cleared up after recompression and very slow decompression without leaving any apparent permanent damage.

The length of the time between the workmen leaving the air-lock and the onset of symptoms is unfortunate as it will be evident that the man will usually be some distance from his work before he is affected. It was therefore our custom to furnish all workers with a letter of identification requesting that he should be returned to us immediately for treatment. This prevented the patient from being detained by the Police or being removed to some hospital where the proper treatment could not be carried out.

Treatment.—This may be summed up into the one word recompression, and the more quickly this is carried out the more satisfactory the result will be.

The Recompression Chamber or Medical Air-lock is usually situated at ground level and near the shaft exit. It is fashioned much the same as an ordinary air-lock but, of course, only requires one door opening inwards, and in the door there is a small window in order that one may see how the patient is progressing. This chamber should contain couches, should be well heated, and hot tea or coffee in flasks should be always available.

The patient is placed in the chamber and the pressure gradually raised until it is 2 or 3 pounds higher than the pressure at which he had been working previously. There are also arrangements for the admission of fresh air into the lock. The beneficial effects of the treatment are very soon evident for, by the time the pressure has reached the desired level or shortly afterwards, the patient passes from his state of acute distress into one of painless comfort and will very often lie down on the couch and fall asleep.

This optimum pressure is maintained for a short time and then the slow process of decompression is commenced and will usually take a period of from two to three hours to complete, varying naturally with the severity of the symptoms. Quite often the pain will return at varying periods from a few minutes to a few hours and in these cases the patient must again be compressed and decompressed, taking even longer time over the decompression.

I have found that if a patient has been in the medical air-lock for periods amounting in all to about five hours, further recompression is not desirable. At our "workings" we had accommodation for bedding the patients

who had not reacted well to treatment in the medical air-lock and further treatment consisted of laying them up in with plenty of hot water bottles and liberal injections of morphia repeated as often as necessary. This line of treatment never failed to be effective.

In very severe cases where apart from the "bends" the patient looked badly shocked, one had to enter the lock along with the patient and administer oxygen, which seemed to help a great deal.

In event, as sometimes happens, of the lock not being available through another patient occupying it, the administration of oxygen is helpful and should be carried on with until the morphia has acted or the lock has become available. I was always in the habit of giving the patient two $\frac{1}{2}$ gr. morphia suppositories to take home with him after being in the medical air-lock, a precaution which probably saved me many night calls.

In a series of about a hundred cases of varying severity we had no casualties which proved fatal and no cases of permanent incapacity. Some men certainly refused to work in the compressed air again but that was simply a matter of taste—"once bitten twice shy."

I hope that this memo, sketchy as it may be, will prove of interest to some. If anyone would like fuller details on any points, I would be only too pleased to correspond, as, being interested in the condition, I would like to hear of the experiences of others. An exchange of views is, in my opinion, always helpful.

THE RECOGNITION OF SCABIES BY THE ARMY MEDICAL OFFICER.

BY CAPTAIN H. F. LUNN, B.Sc., M.B., B.S.,

Royal Army Medical Corps.

SCABIES and associated skin diseases were responsible for a serious loss of military efficiency in the last war. MacKenna (1940) has observed that scabies and pyoderma have again become the most prevalent skin diseases of this war. Much effort has recently been expended in attempts to control the increasing incidence of scabies. Such effort has centred largely in the trial of different methods of treatment. It seems however that as methods are already available which cure the disease with low relapse rates more attention should first be paid to the problem of early and accurate diagnosis. Incidence figures, whether civil or military, record, strictly speaking, the number of cases diagnosed and it is now apparent that latent and atypical cases exist which may escape recognition for several weeks or months (Mellanby, 1941). Further advances in the understanding and control of the disease will only be made when it is diagnosed with greater accuracy and at an earlier date than at present.

ERRORS IN DIAGNOSIS.

The errors most frequently made by the author (and noted in cases sent for treatment from units in a Brigade Group) are a failure to recognize latent and atypical cases of scabies and confusion of other irritating skin diseases with scabies. These errors would not have been recognized or admitted if it had not been possible to observe the same men as their Regimental Medical Officer for eighteen months and latterly to control diagnosis by identification of the parasite whenever possible.

The typical case provides no difficulty of diagnosis but represents a failure to recognize the earlier stages. It does not seem to be generally realized that the presence of even one burrow containing an active parasite constitutes an early stage in the infestation although there may be little or none of the characteristic irritation and the rash may be insignificant or localized. These early lesions are either overlooked at routine skin inspections or, if observed, are dismissed after treatment with palliative skin applications, until the typical rash and irritation occurs and renders the diagnosis no longer in doubt.

Several other skin diseases have been found to simulate scabies and to cause errors in diagnosis. The vesicles of *cheiropompholyx* have been mistaken for burrows. The rash of seborrhœic dermatitis, especially when profuse over the shoulders, has been found to cause lesions in the anterior axillary folds which are similar to the red and inflamed axillary burrows of scabies. When these and other non-specific skin lesions are scratched, a chain of minute scabs has sometimes appeared like a burrow until investigated by a needle and found to lie on the surface rather than within the outer horny layer of the skin. Severe irritation, often worse at night, has occurred in papular urticaria, eczema, and dermatitis due to sensitivity to wool. Pediculosis has had to be excluded in all doubtful cases. Penile lesions and excoriation of the buttocks, often stated to be almost pathognomonic of scabies, have been seen in cases with neurodermatitis, severe acne, furunculosis, and flea bites. All these diseases have been differentiated from scabies by the absence of burrows and by the features typical of the disease concerned.

MEANS OF ENSURING EARLY AND ACCURATE DIAGNOSIS.

(i) *Skin Inspections*.—Routine skin inspections need to be planned so as to enable the Medical Officer to detect active burrows, if possible, before the onset of the characteristic irritation. This is only possible if the men strip completely. Burrows on the penis and axillæ are usually shown up by the reddening and œdema of the surrounding skin. Burrows on the hand and feet are often only visible on close inspection. Excoriation of the elbows and buttocks suggests activity of the disease in these areas.

If the men report at the inspection parade fully dressed there is much con-

fusion and delay while they remove all their clothes. There is consequently a tendency for boots, trousers or shirts to be retained and for only a limited portion of chest, abdomen and thighs to be exposed to the Medical Officer. It has been found more satisfactory for the men to parade in P.T. kit which can be readily and completely discarded. After an inspection of the front of the body and hands each man turns about and kneels up on a box so that his buttocks, elbows and feet can be examined. In this way it has been possible to detect early cases of scabies with only one or two burrows, each containing an active mite, but with no associated rash or excoriation.

(ii) *Identification of the Parasite.*—Mellanby (1941) has emphasized that any research programme should include this means of confirming the diagnosis if the results are to be accepted as reliable. In addition, however, observation of an active *Sarcoptes* will make a definite diagnosis possible in a number of the atypical cases with no obvious burrows visible on clinical examination. The proper management of "relapse" cases is impossible unless a decision has been reached whether a return of dermatitis or infestation has taken place. Several cases have been seen where unnecessary repetition of anti-scabietic treatment has caused an intractable skin hypersensitivity. It is difficult to justify full treatment measures in an early or latent case if only one or two burrows are present, with no irritating rash, unless the living parasite is seen by the Medical Officer and all doubt is removed. The extraction of the mite from her burrow is simple to describe but difficult to execute until performed successfully several times. The procedure used in the cases covered by this survey was as follows:—

The patient is examined in a good light when his skin is warm. A burrow is chosen preferably at first on the hands or feet where the appearance is not distorted by the inflammatory reaction which usually surrounds burrows on the axillæ, arms and penis. The entrance to the burrow is noted and is often marked by an underlying vesicle. At its blind or distal end there is a slight expansion containing the highly refractile and opalescent body of the parasite, visible to the naked eye as a white spot in a good light. Some specimens contain bronze pigment which shows through the roof of the burrow as a dark speck in the centre of the opalescent area. The thin cuticular roof of the burrow over the mite is carefully lifted with the point of a needle which is withdrawn and reinserted gently into the burrow until the mite sticks to the needle and can be transferred to a warm dry slide. It is unfortunate that tradition dictates the use of liquor potassæ for mounting the *Sarcoptes* because this solution prevents the observer watching her vigorous attempts to burrow through the slide or to travel across it when she is warmed. The *Sarcoptes* is examined under a low-power microscope if one is available but a pocket microscope, costing only a few shillings and magnifying about thirty diameters, suffices to demonstrate the characteristic shape and movements of the parasite. This latter instrument is easily portable under active service conditions.

CLASSIFICATION OF CASES DIAGNOSED AS SCABIES.

An attempt has been made to classify correctly the cases sent to a Treatment Centre diagnosed by their respective Medical Officers as Scabies. The results have been as follows:—

- A. *Confirmed Scabies*.—Living parasite observed in all 46 cases.
 - (i) *Typical*. Appearance of rash and history of irritation characteristic. One or more burrows, 35 cases.
 - (ii) *Latent*. One or more burrows detected, but rash and irritation were either absent or atypical. Noted at routine skin inspections, 11 cases.
- B. *Unconfirmed Scabies*.—Living parasite not found, 21 cases.
 - (i) *Clinical*.—Characteristic rash, irritation and burrows but no acarus found either through inexperience or because all mature females had been removed from their burrows by scratching, 11 cases.
 - (ii) *Atypical*.—Rash and irritation suggested scabies but no typical burrows were visible and no alternative diagnosis was possible. These cases were given anti-scabietic treatment as a precautionary measure, 10 cases.
- C. *Not Scabies*.—Rash and irritation atypical and no burrows were visible. An alternative diagnosis was possible in each case. Patients responded to the particular treatment indicated. No anti-scabietic treatment was given, 5 cases.

Total number of cases included in the series, 72.

SUMMARY AND CONCLUSIONS.

- (1) The need for early and accurate diagnosis is stressed.
- (2) Some of the common errors in diagnosis are described and are found to be due to uncertainty in the recognition of active burrows.
- (3) Means of ensuring early and accurate diagnosis are discussed and it is claimed that the identification of the *Sarcoptes* has greatly assisted the author in his attempts to achieve this end.
- (4) A series of unselected cases diagnosed clinically as scabies has been classified as accurately as possible.
- (5) It is claimed that the possibility of recognizing early and latent cases of scabies in the absence of the typical rash and irritation represents an advance in diagnosis which, if widely employed, will facilitate control and understanding of the disease.

The author wishes to express his gratitude to his A.D.M.S., Colonel C. H. K. Smith, *M.C.*, for giving him the opportunity to carry out this work, and to Dr. Kenneth Mellanby for his advice and personal instruction in identifying the parasite.

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TREATMENT OF SCABIES WITH BENZYL BENZOATE.

BY LIEUTENANT E. D. BELBIN,

Royal Army Medical Corps.

THIS is a record of treatment, at a military hospital, of a number of patients infected with scabies, with a 20 per cent solution of benzyl benzoate in spirit.

By the use of this solution economy of time and material can be made; patients need not be away from their duties for more than one day and hospital beds need not be occupied.

Method of Treatment of a Case uncomplicated by Sepsis or Dermatitis.

—The patient is given a hot bath, first soaking for a quarter of an hour, then washing thoroughly with soft soap but not scrubbing. After drying he is painted, once only, with the benzyl benzoate solution, all over excepting for the head and neck. This solution is allowed to dry. The patient is then put into clean pyjamas whilst the clothes are disinfested.

The treatment is given on the day of admission to hospital, the disinfestation of clothing is carried out on the second day and the patient is discharged to duty on the morning of the third day.

After Effects.—The patient has a slight stinging sensation after painting which remains for two or three hours but the relief from the irritation of the sarcoptes is immediate, and he is able to sleep well. By morning all irritation has usually gone but if the patient does complain of any he is given an application of calamine lotion or (if the skin is dry) calamine ointment and this is sufficient to clear it up. Very occasionally the irritation continues for some days and patients are returned as uncured but further applications of calamine quickly relieve. The calamine is applied to the skin without further washing.

Statistics.—Of 960 patients admitted to the skin division 485 (50·5 per cent) had scabies.

Of these 485 scabietics:—

375 (77·3 per cent) were suffering from their first infestation.

50 (10·3 per cent) were suffering from their second infestation.

60 (12·4 per cent) were suffering from their third or fourth infestation.

45 (9·3 per cent) showed severe secondary infection.

26 (5·5 per cent) had dermatitis as a result of previous treatment.

The patients in the last two groups required some treatment for these conditions before having the routine scabietic treatment.

Results.—Of the 485 patients treated 15 (3·3 per cent) relapsed after discharge and were returned for further treatment. Fourteen had a mild irritation which cleared up on treatment with calamine and on one only were living sarcoptes present. It is now five weeks since the last of the

patients under review was discharged and there have been no further returns.

Although there is no proof it may be presumed that the other patients were cured but this presumption is based on somewhat inconclusive evidence for it is possible that a few patients may have relapsed but, as they have been moved out of the area, have been sent to other hospitals.

Source of Infection and Incubation Period.—In the absence of definite evidence the source and date of infection and the incubation period could not be ascertained as patients usually denied contact with infected persons. I was not able to trace infection from other men in the billets. On only three occasions did two men come from one unit at the same time and once three men came together from the Corps guard room. I am inclined to the belief that infection was usually contracted whilst on leave. Eighty-six patients (17·7 per cent) had been on leave in the preceding four weeks, 305 (62·8 per cent) from four to eight weeks before and 94 (19·4 per cent) over eight weeks before and, if my belief is correct, the incubation period is of several weeks' duration. This agrees with Dr. Kenneth Mellanby's opinion of four to twelve weeks as the incubation period (though he states that patients who have been previously infected are sensitized and feel irritation much earlier after infection than others do).

The possibility of infection by sexual contact was suggested by the large number of cases where the lesions first appeared on the abdomen and front of the thighs, and a large proportion of the patients had lesions on the penis early in the course of the disease.

Our knowledge of the incubation period appears to require further investigation.

Conclusions.—When a 20 per cent solution of benzyl benzoate is used (*a*) scrubbing is not necessary, (*b*) one application is sufficient, (*c*) there is no serious after effect, (*d*) in the present series of cases all but one (0·2 per cent) were cured.

Owing to its cleanliness, rapidity of treatment and efficacy it is the best treatment available.

Hospitalization is not necessary where a centre for treatment can be placed conveniently as disinfestation of both patient and clothing can be carried out in about two hours and the patient returned to his unit immediately.

Infection appears to be a result of intimate personal contact, not merely sleeping in the same billets and living and feeding together. It probably comes from civilian sources.

I gratefully acknowledge the help given by Dr. Kenneth Mellanby; also the assistance of Staff-Sergeant Ferris and Private Farmer who administered the treatment to the patients.

Current Literature.

EAGLE, H. **On the Specificity of Serologic Tests for Syphilis as Determined by 40,545 Tests in a College-Student Population.** *Amer. J. Syph.* 1941, Jan., v. 25, No. 1, 7-15.

This paper represents an attempt to answer the following questions as propounded by the author: "(1) What proportion of normal, non-syphilitic individuals, with no apparent complicating disease which may affect the result, give repeatedly positive or doubtful diagnostic tests for syphilis? (2) Is that proportion sufficiently large to invalidate, or even to call into question, the current practice of diagnosing syphilis on the basis of positive serologic tests, even in the absence of definite clinical evidence or history of syphilitic infection?" The problem is complicated by the fact that there can never be a certainly non-syphilitic group of controls, and to meet the difficulty the nearest approach to such a group was sought in white college-students.

From 40,545 students in twenty-five schools as many specimens of blood were examined in the first instance in State health, in municipal or in student hospital laboratories. All positive or doubtful reactions were re-checked by repeat tests and clinical examination of the students concerned. In the first instance there were 73 positive and 117 doubtful reactions, but on re-test the numbers were reduced to 40 and 22, the difference being regarded as due to laboratory errors. Of the 40 positive, 16, and of the 22 doubtful, 5 specimens were from persons with history or signs of syphilis, and 5 others were from students who had been treated for syphilis, leaving 36 (19 positive and 17 doubtful) with no clinical evidence of syphilis. The author says that at first sight the occurrence of 1 possibly false reaction in 1,125 specimens is disturbingly high, but examination of the details shows that the apparently false positive reactions occurred mostly in specimens from colleges with a higher than average proportion of students suffering from proved syphilis. Thus, in ten schools with no proved cases of syphilis there was only one positive reaction in 11,287 tests, but in 7 with 11 cases of known syphilis in a total of 6,783 tested there were 15 others giving repeated positive or doubtful reactions in the absence of clinical evidence or history of the disease. By the application of statistical principles to these figures he concludes that one may reasonably attribute approximately 70 per cent of the clinically unconfirmed positive and doubtful reactions to latent syphilitic infection. On this basis it is concluded that in this series of tests the proportion of unconfirmed positive or doubtful reactions was 1 : 4,000. The proportion is so small as to justify "as a general public health measure, the diagnosis of syphilis in clinically normal individuals on the basis of repeated positive serologic tests, even in the absence of history or clinical evidence of syphilitic infection."

L. W. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 6.

Reviews.

SURGERY OF MODERN WARFARE. Second Edition. Vols. I and II. Edited by Hamilton Bailey, F.R.C.S. Edinburgh: E. & S. Livingstone. 1942. Pp. xxviii + 1,000. Price 40s. each volume.

The second edition of this work has now been brought out in two volumes. This is far more convenient for the reader and is a great improvement.

There is a great deal of very practical information in these volumes. Such sections as those on the application and use of plaster of Paris, the use of Cramer's wire, the details of wound excision, exposures of the main blood-vessels and the management of the bladder in spinal injuries are all most useful. The chapter on wounds of the thorax is excellent.

The Editor, contributors and publishers are to be highly congratulated on the production of a practical and up-to-date textbook on the surgery of modern war.

J. M. W.

ILLUSTRATIONS OF REGIONAL ANATOMY.—In Seven Sections. By E. B. Jamieson, M.D. Edinburgh: E. & S. Livingstone. 1942. Bound Volume 60s.

This is the fourth edition of this series of Anatomical Illustrations and the chief advance is in colour. 163 new colour blocks have been introduced in the fourth edition of Sections I—V, and 79 in the third edition of Sections VI and VII. This has resulted in a marked improvement.

These illustrations are now as nearly perfect as can be imagined. They should be of the greatest value to students of anatomy and to surgeons for a quick revision of any anatomical details.

The author and publishers are to be heartily congratulated on the production of a most useful and practical series of anatomical diagrams.

J. M. W.

A POCKET MEDICINE. By G. E. Beaumont, M.A., D.M.Oxon, F.R.C.P., D.P.H.Lond. London: J. & A. Churchill, Ltd. 1942. Pp. vi + 202. Price 10s. 6d.

Dr. G. E. Beaumont, already well known to physicians and students as a medical author, has produced a new condensed textbook entitled "A Pocket Medicine." In a light linen cover it is excellently produced, easily readable and wonderfully compact, consisting of only 200 pages. It has what the reviewer considers the advantage of being written in literary rather than in tabular style.

It suffers from the defects common to all attempts to abbreviate a vast subject to bare essentials. Thus there is not sufficient scope for adequate description of the patient's general condition and appearance, and the finer points in history taking, which play so important a part in diagnosis. Though in such a book one would not look for a description of the rarer

diseases or of the less common types and complications of better-known ailments, it is nevertheless true that to most students and practitioners it is the typical case which remains in the memory and the difficult or obscure problem in which we look for textbook assistance. An abbreviated volume, in other words, tends to contain all that we already know and omit that for which we seek guidance. It is, moreover, difficult to point out the importance of one symptom or disease and the relative insignificance of another when explanation must be sacrificed to brevity.

On the whole, Dr. Beaumont has succeeded fairly well, and his remarks on treatment are especially commendable and always up to date.

The section on the nervous system gives a good account of the classical signs of the diseases described, many of which are difficult to remember, but we were surprised to find that meningeal signs in subarachnoid hæmorrhage had been overlooked.

The periodicity of gastric and duodenal ulcer, so often a determining factor in differential diagnosis, is scarcely mentioned, and more stress might have been laid on the dangers of agranulocytosis which is not described as being a serious and often fatal syndrome.

The author in his preface expresses the hope that amongst other uses the book will prove of value to medical officers in the Services proceeding overseas. In this connexion the sections on tropical diseases and on poison gases will especially appeal.

To sum up, then, such a book, though it can never replace a bigger textbook, has a distinct value, and this miniature volume is certainly one of the best of its kind.

R. P.

WAR INJURIES OF THE CHEST. By H. Morrision Davies, M.Ch., F.R.C.S., and Robert Coope, M.D., F.R.C.P. Edinburgh: E. & S. Livingstone. 1942. Pp. viii + 131. Price 6s.

A well produced small book of 131 pages with clear instructive illustrations; the general surgeon who is unaccustomed to thoracic surgery will find the chapter on the anatomical and physiological background and the careful details of the management of hæmothorax of special value. The authors prefer evipan anæsthesia to local anæsthesia for the minor operation of hæmothorax aspiration but the reviewer doubts if the majority of thoracic surgeons and physicians would agree with this recommendation. The advice given about the methods for establishing closed drainage in infected hæmothorax cases is most valuable and should help to disperse the unreasonable objection of some general surgeons to this method which can be employed earlier and more safely than the unphysiological operation of open drainage.

A very full chapter on Anæsthesia by Dr. John Halton discusses the large range of anæsthetics available. A word of caution about the use of intravenous barbiturates (which as the writer says have many uses) is given but the reviewer is sorry to read "Anæsthesia may be induced with ethyl chloride"—surely not a drug for use in thoracic surgery.

A final chapter on "After Care" is most helpful and practical.

The general impression is that major intrathoracic surgery is not the most important thing in the management of war injuries of the chest, though it has its own valuable and dramatic role especially for large foreign bodies.

A. L. D'A.

THE THEORY AND PRACTICE OF MASSAGE AND MEDICAL GYMNASTICS. By Beatrice Goodall-Copestake. London: H. K. Lewis & Co., Ltd. 1942. Pp. xx + 370. Price 16s. net.

It is a pity that in these days when physical medicine is at last becoming established on a solid scientific footing, that this sixth edition should appear twenty-five years after the first with so little critical examination of underlying physiological principles. The value of massage of the præcordium in heart disease, of abdominal manipulations to increase gastric secretions and of frictions for regenerating nerves is discussed with no less assurance than its proven value in fibrositis. Moreover the ambition of the author is a weak point. One has the impression that the book is intended for the students of massage, the qualified masseuse and the medical practitioner. Valuable space is used in discussing the derivation of words and dates and passages are unnecessarily devoted to such topics as gastric ulcer, diabetes mellitus and insipidus, and chlorosis, this requiring a shortening of the discussion on posture, nerve injuries and sciatica where more instruction would have been helpful. In the chapter on passive movements one is disappointed to find no mention of lateralization of joints as this is considered by Mennell and many others of prime importance. On the other hand there is a good section on the treatment of amputation stumps in the new chapter on war injuries and the book, for which there is an obvious need, is well produced and has excellent plates. It is a pity, therefore, that an attempt to cover too great a field and some lack of critical judgment has reduced its usefulness.

G. D. K.

Notice.

SYNTHETIC VITAMIN K.

Menaphthone-Boots and Acetomenaphthone-Boots are synthetic Vitamin K analogues which have the same physiological properties and are more potent than natural Vitamin K. Menaphthone-Boots is the approved name for 2-methyl-1:4-naphthaquinone and Acetomenaphthone is 1:4-diacetoxy-2-methylnaphthalene. Menophthone and Acetomenaphthone are indicated in the treatment of neo-natal hæmorrhage and in conditions where digestion of fats is disturbed or inhibited, or absorption deranged, e.g. obstructive jaundice, biliary fistula, idiopathic steatorrhœa and celiac disease.

Literature may be obtained on request to the Medical Department, Boots Pure Drug Co., Ltd., Station Street, Nottingham.

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Original Communications.

SOME EXPERIMENTAL WORK ON INFECTIVE HEPATITIS
IN THE M.E.F.

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INFECTIVE hepatitis or epidemic catarrhal jaundice, also alluded to in military medicine as the jaundice of campaigns, is a disease of world-wide distribution. Since the discovery of *L. icterohæmorrhagiæ* in 1914 by Inada *et al.* (1916), infective hepatitis or so-called catarrhal jaundice has been recognized as a clinical and pathological entity separate from spirochætal jaundice. Both diseases were encountered during the Great War, 1914-18, and were extensively studied by many observers. Spirochætal jaundice was prevalent in the French, German and British Armies of the Western Front and a lesser number of cases were reported from Gallipoli. Epidemic catarrhal jaundice, on the other hand, presented a different distribution. In France and Flanders, cases occurred singly or in groups, whereas in the Eastern theatres of war, notably in Alexandria (July, 1915), Gallipoli, Mudros, Salonika and Mesopotamia, it appeared in epidemic form. According to the History of the War. Medical Services. Diseases of the War. Vol. I,

676 cases of jaundice were evacuated from Suvla Bay and 456 of these affected the 53rd Division. Other interesting facts on record were that, on evacuation of the Peninsula in December, 1915, jaundice from Suvla Bay was brought back to Egypt by the 53rd Division but rapidly died out by the end of January, 1916. The 10th Division carried it from Suvla Bay to Salonika when a third of the total sick admitted to hospital suffered from the malady. Subsequently for some inexplicable reason it vanished spontaneously in December, 1915, and did not return. The 13th Division bore the disease with them from Suvla Bay to Egypt and thence to Mesopotamia where epidemic jaundice recurred and 555 cases were notified in June, 1916. In concluding his remarks, Hunter makes the interesting comment that "The usual history in any battalion affected commenced with one or two isolated cases; then there was an interval of about three to four weeks, then a large number of cases for three weeks, finally an occasional case for a few more weeks."

During 1915-16, specimens of blood, urine and liver biopsy tissue were examined bacteriologically by Captain (now Professor) T. J. Mackie, R.A.M.C., but no specific organisms could be isolated and the ætiology of epidemic jaundice remained obscure.

Today another epidemic of jaundice has appeared in the Middle East theatre of war and we have again tried to elucidate its nature by the employment of all available methods. The number of cases at our disposal has been sufficient to provide us with a constant supply of blood, stomach washings and bile from early and late stages of the illness. Such material has been subjected to intensive bacteriological, cytological and animal inoculation tests. Our laboratory findings have been in the main negative but the extent of ground covered is reported below. The description of technical work is followed by a discussion on the ætiology of the disease.

OBSERVATIONS ON BILE.

Technique of Obtaining Specimens.—The method of duodenal intubation as recommended by Lyon (1923) was adopted with the exception of the volume and concentration of the magnesium sulphate solution used as a cholagogue. Lyon advises the use of 75 c.c. of 33 per cent solution of magnesium sulphate but it has been shown by Fidler, Innes and Davidson (1941) that magnesium sulphate in such concentration is highly irritant to the duodenal mucosa with the resultant production of large numbers of epithelial cells.

Consequently we used as a cholagogue 5 to 10 c.c. of a 25 per cent solution of magnesium sulphate. The employment of this volume and concentration, which was sufficient to excite a satisfactory flow of bile, as much as 200 c.c. in one case, did not appear to cause desquamation of duodenal epithelium.

Clinical Data.—Samples of bile were aspirated by duodenal intubation from eleven patients in different stages of infective hepatitis. During the

first week of the illness the presence of anorexia, nausea and vomiting made the passage of the duodenal tube exceedingly difficult but, in seven instances, this was successfully accomplished. In the later stages of the disease the procedure was easier. In four subjects, notwithstanding the existence of jaundice accompanied by clay-coloured stools, a small quantity of bile was recovered by the duodenal tube. It thus seemed that there was no complete stoppage of the bile flow in the cases which we studied. In four patients we were able to withdraw bile within twenty-four to forty-eight hours of the reappearance of normal stools. This was performed to investigate the characteristics of the early flow of bile immediately after a period of suppression varying from five to fifteen days (*see* Table I).

Control material comprised bile obtained from six healthy male adults by precisely similar methods. It was subjected to the same treatment.

TABLE I
DUODENAL INTUBATION

Case no.	Day of jaundice	Quantity of bile removed	Stool	Remarks
1	2	10 c.c.	Clay	Average case.
2	5	40 c.c.	Clay	Moderately severe case.
3	5	200 c.c.	Clay	Mild case.
4	5	100 c.c.	Light brown	Clay stools on previous day.
5	6	80 c.c.	Light brown	Clay stools on previous day.
6	7	100 c.c.	?	Average case.
7	7	20 c.c.	Normal	Average case.
8	8	70 c.c.	?	Severe case.
9	10	20 c.c.	Clay	Average case.
10	14	90 c.c.	Normal	Jaundice clearing.
11	15	10 c.c.	Normal	Jaundice clearing.

BACTERIOLOGICAL EXAMINATIONS.

All the bile collected from each patient was pooled, 10 to 15 c.c. were centrifuged in an angle centrifuge at 5,000 r.p.m. for one hour, the supernatant fluid discarded and the deposit plated out on a variety of solid media. The following were employed: Serum agar; 4 per cent horse blood agar; coagulated sheep blood; Dorset's egg medium; Löffler's serum medium. A few fluid media were also utilized and consisted of glucose broth, brilliant green in peptone water and sodium tetrathionate media. The Dorset's egg and cooked meat were incubated at 37° C. for a month and the remainder for three to seven days prior to examination.

Conclusion.—No specific micro-organisms were isolated with constancy. Precisely the same bacterial flora was present in both normal and in pathological material and comprised staphylococci, hæmolytic and non-hæmolytic enterococci, pneumococci, coliform bacilli, large Gram-positive bacilli, yeasts and moulds. No spirochætes, parasites or ova were detected.

Microscopical Observations.—Films were prepared from each specimen of bile after centrifugation. These were examined by dark field illumination as well as after staining by each of the following procedures. Gram:

Fontana silver impregnation; Neisser; Ziehl-Nielsen; Paschen's stain for virus elementary bodies and lastly Giemsa's prolonged staining technique.

From a study of the foregoing methods of staining it will be appreciated that they are comprehensive enough to demonstrate a wide range of pathogenic micro-organisms as well as large cellular elements.

Conclusion.—About one hundred microscopic preparations were scrutinized closely but they failed to reveal any significant constant differences between the bacteriological constituents of bile obtained from cases of infective hepatitis on the one hand and normal (control) bile on the other.

A search was conducted for virus bodies but none were found. In the absence of a susceptible experimental animal, such a procedure becomes very difficult because suspicious particles of organized matter or other structures noticed cannot be associated with the disease.

CYTOLOGY OF BILE.

Special attention was paid to the results of investigations on bile originating from patients whose stools were either clay-coloured or alternatively the colour of which had returned to normal for a day or two.

On each occasion the centrifugalized deposit contained relatively scanty lymphocytes, polymorphs and amorphous granular debris which predominated in the field. Indeed, there was no difference between the pathological and normal specimens. Consequently, there was nothing to suggest the existence of inflammation of the columnar epithelial lining of the large bile canaliculi.

Collectively, bile from eleven selected cases of infective hepatitis was examined but in no instance was there evidence of biliary catarrh. It may well be that owing to the necrotic action of bile a large number of cells are destroyed but this fails to account for the absence of inflammatory cells in the acute phase of the disease.

EXAMINATION OF GASTRIC CONTENTS.

The fasting gastric juice was examined in thirty-six cases. Samples were removed during the first few days of jaundice and later during convalescence when icterus had practically disappeared. Nine cases showed achlorhydria at the commencement of illness with the return of free acid during convalescence. On the other hand twenty-five cases showed variations in the amount of free acid of not more than 10 c.c. of N/10 HCl.

Likewise the amount of mucus at different stages of the disease lay within normal limits.

Proof of gastric catarrh was lacking but gastroscopy would be necessary to confirm this finding.

Conclusion.—We have found no evidence of biliary or gastric catarrh to support the contention that jaundice is caused by obstruction. Infective hepatitis as studied by us appears to be due to a toxic process affecting primarily the liver parenchymal cell, resulting in reduction of biliary secretion.

This loss of function of the bile-secreting mechanism may be adequate to explain the occurrence of jaundice.

ANIMAL INOCULATION EXPERIMENTS.

Bile and stomach washings were secured from ten cases and animals were fed with large volumes of each specimen.

Mice, white rats, jerboas, rabbits, guinea-pigs, monkeys (Lasiopyga griseivirdis or Cercopithecus æthiopsis), Abyssinian baboons (Papio hamadryas), a young pig and three kittens were employed.

Blood, containing 1 per cent sodium citrate, was withdrawn from twenty proved cases of infective hepatitis during the febrile, pre-icteric and early icteric phase of the illness. It was introduced in each of the above-mentioned animals by one or other of the following routes—subcutaneously, intravenously, intraperitoneally, intracerebrally, intratesticularly and intracorneally. The animals were maintained under observation for six to eight weeks and subsequently discarded. No definite results were forthcoming. There is one point worth mentioning, which may constitute a source of error, in connexion with animal inoculation tests with blood obtained from cases of infective hepatitis. On four separate occasions it was noticed that mice and rabbits, injected intracerebrally and intraperitoneally, died three to seven days later. Saline emulsions of liver, brain and spleen were promptly prepared from such animals, examined aerobically and anaerobically for bacteria, and passaged to fresh stock, but the latter remained unaffected. At first the effect was difficult to interpret but it now seems likely that death of the animals was attributable to traces of bile salts, pigments and toxic substances in patient's blood. It is well known that formed bile (whether normal or pathological) when injected into skin or other organs is an intensely necrotic substance. Its dermo-necrotic effect can be demonstrated in the rabbit by injecting 0.2 c.c. of normal bile intradermally. We also noticed that if 0.3 c.c. of serum from a deeply jaundiced patient was injected subcutaneously in a rabbit an area of localized erythema developed after twenty-four hours and rapidly disappeared without necrosis.

Consequently apparent initial positive animal inoculation results should be accepted with reserve and a second passage attempted before drawing any conclusions.

One young *pig* about 6 weeks old was injected intraperitoneally with 25 c.c. of blood from two early cases of infective hepatitis, forcibly fed with pooled stomach washings of twenty-three different cases, and inoculated intraperitoneally with 100 c.c. of a Seitz filtrate of stomach washings from three additional cases of infective hepatitis. The animal was kept under observation for three months but remained well and thrived.

Another interesting negative experiment was one in which large volumes of blood from two febrile cases of infective hepatitis were introduced in two large *Abyssinian baboons* but without ill-effect. Each creature received 20 c.c. in the peritoneum, 5 c.c. in the liver and 5 c.c. in the testicles. The

results were negative as far as could be judged. No temperature chart was kept owing to the difficulty in handling such obstreperous beasts.

One *Cercopithecus* monkey was injected in the liver and peritoneum with 10 c.c. of the citrated blood and seven days later a transient rise in temperature occurred which lasted for a week accompanied by slight diarrhoea. No explanation (e.g. monkey malaria) was found to account for the swinging pyrexia and it was assumed that the inoculum was responsible for it.

Similar species of monkeys injected with blood procured from non-infective hepatitis cases did not react in this manner.

Neutralizing tests are required before the specificity of the pyrexia can be claimed. Unfortunately these are beyond the scope of our meagre local facilities; moreover it is dubious if this angle of approach is likely to yield practical results because the monkeys used are either non-susceptible to infective hepatitis or else only feebly so and, as such, are of little use as experimental animals.

It is interesting to recall that Findlay (1940) likewise produced a transient febrile reaction in Rhesus monkeys eleven to fourteen days after feeding them with blood taken from patients during the first seven days of illness.

Animal Histology.—In order that the existence of inapparent infection might not have passed unrecognized a number of mice, jerboas, rats, rabbits and guineapigs were killed from two to six weeks after they had been inoculated with blood or fed with bile and stomach washings and their tissues examined histologically. No lesions were found.

IMMUNOLOGICAL EXPERIMENTS.

Since pyrexia often occurs at the onset of infective hepatitis several convalescent sera were tested for the possible presence of agglutinins for *B. proteus* X19, ONK and OX2, *Brucella abortus*, *melitensis* and *B. paratyphosus* C. Findings were constantly negative.

Yellow Fever Mouse Protection Tests.—Sera from eight convalescent cases of infective hepatitis ranging in duration from two to twelve months were subjected to mouse protection tests by Doctor Mahaffey of the Rockefeller Yellow Fever Research Institute, Entebbe, Uganda. All tests were returned negative; thus virus neutralizing antibodies for yellow fever were absent in infective hepatitis as observed in Egypt. So far as the present epidemic and our studies are concerned the question of jaundice due to yellow fever vaccination does not arise (see Findlay *et al.*, 1939).

Histology of Human Liver in Infective Hepatitis.—Despite its high morbidity the mortality rate from infective hepatitis is negligible. Pathologists in the Middle East have kept a sharp lookout for fatal cases and the following is a description of the morbid histological changes found in the liver of a patient who presumably died from an unusually severe attack of the malady.

Major D. T. Stewart, N.Z. General Hospital, provided us with a histological section of liver derived from a fatal case of the disease. The lesions were recently described by himself at the Conference of Pathologists, G.H.Q., M.E., 19.3.42. In brief, the essential features were as follows: Liver parenchyma showed much cloudy swelling and eosinophilic staining with considerable peripheral lobular necrosis. Lymphocytic and plasma cell infiltration was present together with karyorrhexis and karyolysis of liver cell nuclei. The bile canaliculi were distended and contained inspissated bile but there was no sign of inflammation of these channels.

The sections forwarded to one of us were scrutinized for acidophilic intranuclear (Torres) inclusion bodies but none were noticed. Likewise a search for Councilman bodies proved in vain. Dark-field illumination of the section was also negative. The general impression gained was that the appearances of liver from the fatal case of infective hepatitis were unlike that found in yellow fever damage. In conclusion, the histological changes support the observations made in connexion with the cytology of bile in that the essential lesion in the organ is damage to liver-parenchyma cells and not inflammation of bile canaliculi.

CONVALESCENT SERUM THERAPY.

Convalescent serum was administered to nine selected cases. Serum was derived from six different cases of infective hepatitis four to six weeks after recovery. Prior to use each batch was passed through a Seitz filter, Kahn tested and proved to be bacteriologically sterile.

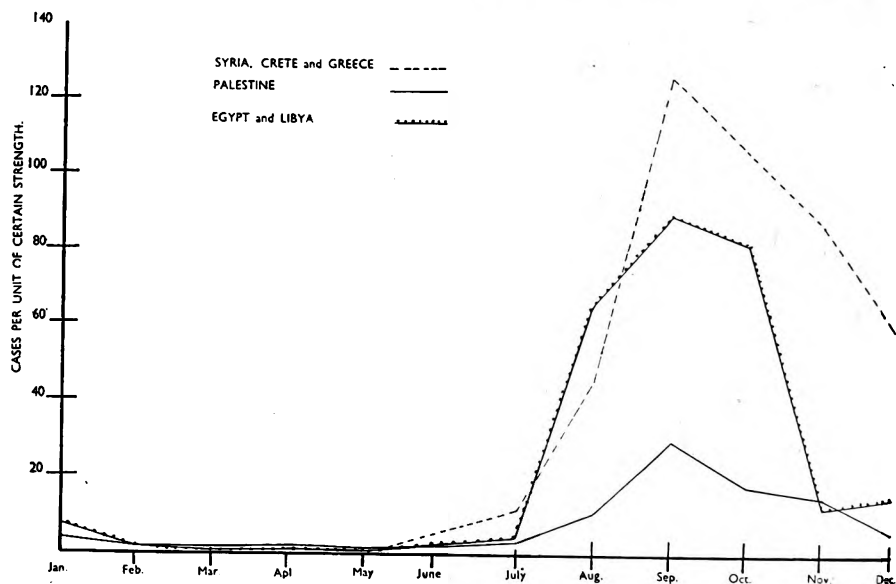
Owing to the difficulty of obtaining patients in the pre-icteric phase of the illness consecutive cases within twelve to twenty-four hours of the onset of jaundice were chosen. Six received 10 c.c. and three cases received 20 c.c. of serum intramuscularly. The icterus index was estimated before the administration of serum and thereafter daily to ascertain whether its exhibition ameliorated the clinical course of the malady.

The results showed that serum failed to control the degree and duration of jaundice. Likewise serum had no effect on the anorexia, nausea and flatulent dyspepsia which were complained of by some patients during the first few days of jaundice. From the above results it appeared to us that human convalescent serum in no way modified the course of the established disease.

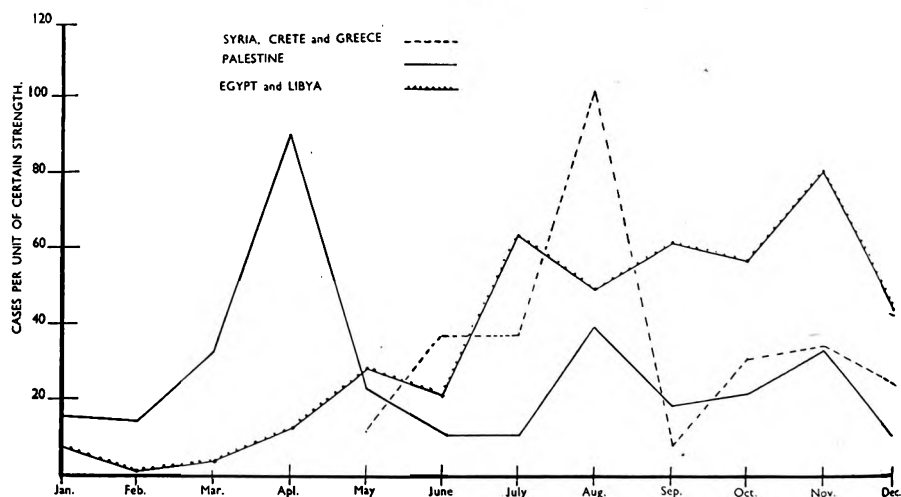
Epidemiology of Infective Hepatitis in a Large Unit of the M.E.F.—Through the courtesy of Colonel N. Hamilton Fairley, Graph I was provided by Lieutenant J. B. Fletcher, Officer Commanding Statistical Sub-section Medical History and Information Section, and indicates the numbers of infective hepatitis patients admitted to hospital for a certain force in the Middle East during 1941. Graph II depicts the incidence of dysentery for the same period among the same group of soldiers.

Epidemic jaundice reached the maximum simultaneously in Syria, Crete, Greece, Palestine, Egypt and Libya during the month of September and, in

Syria, Crete and Greece, altogether 126 cases per "unit of certain strength," were notified (*see* Graph I). Lieutenant J. B. Fletcher, O.C. Statistical Sub-Section, in his interpretation of Graph II, states that during 1941 the



GRAPH I.



GRAPH II.

peak incidence of dysentery occurred in August for *Greece, Crete and Syria*, and in November for *Libya and Egypt*. The peak for *Palestine* recorded in April he commented "is I think largely spurious as there were large troop movements at that time and the relationship of the sickness figures for all

theatres does however show a slight peak in April—May.” Finally he closed with the remark that “I cannot see any correlation between the incidence of jaundice in September—October and the incidence of any other disease.” Neither did the frequency of respiratory infection (as exemplified by pneumonia) shed any light on the problem. The aggregate of pneumonia cases was so small as to make statistical deductions impossible.

Conclusion.—From the statistical data applicable to a large body of troops it was not possible to correlate or otherwise link the 1941 epidemic of infective hepatitis with any other disease or ascertainable obvious factor. There is a remote probability that the dysentery peak in August and jaundice peak a month later in September may be related on the grounds that the incubation period of infective hepatitis is four to five weeks. It is thus conceivable that both dysenteric infection and infective hepatitis were acquired simultaneously during August and disseminated *via* the same mechanism. Unfortunately, coincidence may equally well explain the above result.

DISCUSSION.

Infective hepatitis ranks among the most refractory types of disease amenable to scientific investigations. The long incubation period and the absence of a susceptible laboratory animal together constitute a formidable obstacle to progress in any direction. From clinical evidence, a multiplicity of types of the disease is said to occur. Hurst and Simpson (1934) describe two varieties of catarrhal jaundice, namely epidemic catarrhal jaundice and infective hepatic jaundice, both arising in epidemic form. Lisney (1937) mentions a probable third type, namely simple catarrhal jaundice occurring sporadically. Findlay (1940) also contends that on pathological evidence there are two kinds of epidemic jaundice—true catarrhal or obstructive jaundice and infective hepatitis—but adds that clinically there are no symptoms by which they can be differentiated. The literature contains numerous excellent descriptions of liver lesions found at biopsy and autopsy in cases of infective hepatitis and, for these, the reader is referred to the publications of Morgan and Brown (1927), Findlay and Dunlop (1932), Gaskell (1933), Cullinan (1939), Roholm and Iversen (1939), Findlay *et al.* (1939) and Findlay (1940).

The general non-specific character of the histological picture in infective hepatitis is well epitomized by Cullinan (1939) in the following paragraph: “In true catarrhal jaundice the parenchymal necrosis is mainly in the central zone of the lobule and that obstruction of the bile ducts with cholangitis is a condition which constantly brings about such a central necrosis by pressure alone. With this I agree, but an initial central necrosis is also the outstanding characteristic of primary acute necrosis of the liver where there is no question of obstruction.” Thus study of the hepatic morbid histological architecture does not reveal the cause of liver cell damage in infective hepatitis.

Diversity of opinion has also been expressed on the ætiology of infective hepatitis. Hurst (1940) contends that epidemic jaundice occurring in Gallipoli and Mesopotamia during the Great War was obstructive in character and was caused by gastro-duodenal catarrh. The official History of the War. Medical Services. Diseases of the War. Vol. I, contains the following passage:—"The cause of the jaundice in these cases seems to be obstruction in the biliary tract. The symptoms are not usually severe or lasting enough for there to be any involvement of the smaller ducts within the liver and are best explained by swelling of the papilla of Vater as part of a duodenal inflammation due to the localization of infection in the duodenum." In two autopsies Willcox (1922) reported that there was intense catarrh of the duodenum and larger bile ducts and Jones and Minot (1923), from a study of duodenal contents in twenty-six cases of catarrhal jaundice, concluded that jaundice was due to intestinal infection which spread up the biliary tract.

Views contrary to the above have been expressed by Cullinan (1939), Newman (1942) and others, all of whom assert that infective hepatitis or epidemic jaundice is a toxic hepatitis which may appear in sporadic or in epidemic form.

We, too, support the above hypothesis and are in complete agreement with the remark expressed by Lieutenant-Colonel Cullinan (in a personal communication) that infective hepatitis as it now occurs in the Middle East Forces is identical with so-called epidemic and sporadic catarrhal jaundice afflicting civilians in Great Britain.

At present a series of investigations is in course of progress to ascertain the degree of liver damage in cases of infective hepatitis by means of the hippuric acid test. Although the results are incomplete preliminary findings indicate that well-marked liver inefficiency is present. The wider application of this test and other liver efficiency tests should prove helpful in the recognition of liver damage in infective jaundice.

Every endeavour we have made to transmit the condition to laboratory animals has failed and we are reluctantly compelled to resort to speculative reasoning as to its ætiology and mode of propagation. No specific bacterium has been isolated and a search for a virus agent has been unrewarded. From the epidemiological point of view, the position cannot be correlated with any known insect or animal vector and, similarly, water, food and fomites do not seem to be implicated. It is interesting however to recall that the outbreak which occurred at Mount Allison in Canada was due to water borne infection (*see* Fraser, 1931).

Confronted with such a baffling situation there is no alternative but to surmise that the reservoir of infection is man, among whom the disease is disseminated by droplet infection, and that the rapidity with which it spreads throughout a district is more compatible with a virus infection than any other group of pathogenic agent.

The area in which we have worked has been one of active troop movements and, although 180 cases have been treated by one of us, it has been

expressed on the aetiology of epidemic jaundice occurring at War was obstructive in the biliary tract. The official History of the War. Vol. I, contains the following statement: "In these cases seems to be that the smaller ducts within the papilla of Vater are blocked, and the infection in the ducts is intense enough to cause that there was intense catarrh of the biliary tract." (Cullinan and Minot 1923). In cases of catarrhal jaundice, which spread up the biliary tract, the infection has been expressed by Cullinan and Minot as "infective hepatitis" which may appear in sporadic cases and are in complete contrast to the epidemic and sporadic catarrhal jaundice.

is in course of progress in infective hepatitis by means of incomplete preliminary symptoms. The wider spread of the disease should prove helpful in the future.

transmit the condition to others, and are compelled to resort to special propagation. No specific agent has been unreservedly accepted as the cause of the disease. Similarly, water, food and clothing, however to be treated, as in Canada was done.

There is no alternative to the rapidity with which the disease spreads with a virus infection. It has been one of active interest to be treated by one of us.

impossible accurately to trace contacts and to calculate the incubation period. It has been estimated at four to five weeks.

Newman (1942) has suggested that the disease may be perpetuated in man by ambulatory unrecognized cases of infection. We not only concur with his opinion but would go further by stating that at the time of an epidemic in all probability a *very large number* of individuals are exposed to infection and the reaction of each varies according to his susceptibility. Thus a person may develop signs and symptoms ranging from those simulating a mild attack of "influenza," "gastritis" and the like to a typical attack of infective hepatitis. The ambulatory patient may thus harbour the disease and constitute the source of infection to others.

We suspect that numerous abortive cases develop during an epidemic but they are difficult to identify and in all probability never reach hospital. We have seen three such patients whom we diagnosed as cases of infective hepatitis without jaundice and details of them are as follows:

On November 2, 1941, Major G. A. G. M. took ill with retro-ocular headache, malaise, anorexia, marked nausea and vomited once. There was fever of 99° to 101° F., tenderness in the right hypochondrium but no hepatic enlargement; w.b.c. 3,800; polymorphs 63 per cent; lymphocytes 30 per cent; monocytes 5 per cent; eosinophils 1 per cent; basophils 1 per cent; icterus index 9 per cent; plasma cholesterol 110 mgm. per cent. The urine was examined daily and bile salts and pigment were found only once (November 6, 1941). Anorexia and flatulent dyspepsia persisted for fourteen days. The onset of jaundice was confidently anticipated but it did not develop.

In January, 1942, one of us (I. G.) developed malaise, complete anorexia, slight nausea at the sight and smell of food and a feeling of abdominal distension as soon as a few mouthfuls of food were swallowed. On two occasions a temperature of 99° F. was recorded. No biliuria or jaundice developed and recovery occurred in four to five days.

Signalman J. C. was admitted to the jaundice ward for dyspepsia and pes cavus. On the 26th day after admission he developed similar symptoms and slight fever of 99° to 100° F. There was tenderness over the liver but no biliuria or jaundice developed. The icterus index was 11 and the hippuric acid test showed the liver efficiency to be 75 per cent of normal. In five days he had completely recovered.

We have discussed this subject with a number of Regimental Medical Officers who think they too have seen similar types of cases although they have not had any reason to allocate them to this category. Dyspepsia is so common a symptom in the Army that the recognition of the abortive case of infective hepatitis on purely clinical grounds is difficult.

In addition to the symptomatology, which resembles that of the pre-icteric stage of the disease, three tests may be of help. (1) Examination of the urine for the presence of bile and urobilinogen; (2) the intradermal histamine test (see Cullinan 1939) and (3) the icterus index. We suggest that investigations on these lines would furnish valuable information concerning the occurrence and numbers of abortive cases, which are of great epidemiological importance.

First it would seem that at the time of an epidemic the exposure rate is very high and a large number of men become exposed to infection. Secondly the reaction of such individuals would depend on their state of immunity. Thus it is quite probable that many would suffer from the customary signs and symptoms experienced during the pre-icteric febrile period of the disease and then recover completely. More receptive persons, on the other hand, after experiencing the systemic phase of the illness may become jaundiced. It may well prove to be that at the peak of an epidemic the disease spreads with great rapidity throughout the military population and that cases showing jaundice represent a fraction of the total number infected. The ratio of immune to non-immune persons also seems to be high. We have watched a patient who was transfused with one pint of blood derived from a donor who developed symptoms of infective hepatitis a few hours after he had been bled. The recipient was kept under observation for two and a half months and he did not develop the disease. Moreover during the recent epidemic in the Middle East although many blood transfusions were given (at the time of the second Libyan campaign) we only know of two cases which may conceivably have contracted jaundice as the result of having received blood from donors in the incubation stage of the disease. Therefore our opinion is that the risk of the disease being transferred by transfusion is negligible—and is as small as the chance of transmitting any other infective condition by the same means.

Convalescent serum has not convinced us that it is of therapeutic value in dealing with the established disease and further work on this aspect of the problem may well be directed towards prophylactic measures.

With regard to other measures little else can be advocated. Much remains to be discovered and, pending such time as controlled human volunteer or positive animal transmission experiments are instituted, the outlook seems bleak.

CONCLUSIONS.

- (1) So far, every effort to find a specific bacterium or virus entity in the blood, bile and stomach washings from cases of infective hepatitis has failed.
- (2) Despite determined efforts to discover a susceptible experimental animal none has been found.
- (3) Infective hepatitis as observed by us in the M.E.F. is essentially a benign illness which may or may not be followed by jaundice.
- (4) In cases showing jaundice we have found no indications of obstruction or catarrh of the bile passages and therefore consider that the associated jaundice is toxic in character and primarily due to damage of the liver parenchymal cell.

ACKNOWLEDGMENTS.

We take this opportunity of expressing our gratitude to Dr. R. P. Wilson and Dr. J. O. W. Bland of the Memorial Ophthalmic Laboratory, Giza, for their great hospitality and the facilities which they so cheerfully placed at

our disposal, and also to Colonel H. D. F. Brand for his permission to publish this paper and Brigadier W. D. Small and Colonel J. S. K. Boyd for their interest and helpful encouragement.

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DYSPEPTIC CONDITIONS IN THE ARMY.

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Royal Army Medical Corps.

DURING the period November, 1940, to May, 1941, 150 men were admitted to the "Gastric" ward for investigation and treatment. The majority of these cases had been seen in consultation as out-patients having been referred by their Regimental Medical Officers as probable cases of peptic ulceration. No account has been taken of cases in which the digestive symptoms were obviously secondary to some other disease, e.g. catarrhal jaundice, ulcerative colitis and pulmonary tuberculosis. Re-admissions are not regarded as new cases.

The routine method of the special investigations was:—

- (1) A fractional test meal on the day following admission or as soon after as convenient.
- (2) Chemical test for occult blood in the stool on the fourth day of diet.
- (3) Radiological examination.

The criteria on which the necessity of radiological examination was based were (a) the history of the patient; (b) fractional test meal findings; (c) the presence of occult blood in the stool; (d) persistence of symptoms while under treatment. A history suggestive of peptic ulceration with hyperchlorhydria and/or occult blood in the stool was an indication for a barium meal X-ray. The fourth factor (d) was considered when the combination of the first three failed wholly to satisfy what may be termed the classical clinical picture of gastro-duodenal organic trouble.

By these means it was found possible to classify the cases in four main groups:—

- A.—Peptic ulceration.
- B.—Gastro-duodenal irregularities.
- C.—Gastritis.
- D.—Dyspepsia
 - (1) of probable known cause.
 - (2) of no known cause.

No case of gastric neoplasm was found in the series.

A.—PEPTIC ULCERATION GROUP.

It was found that of the 150 dyspeptics admitted 32 (22 per cent) had radiological evidence of peptic ulceration. This percentage is lower than that found in the Army series analysed by Payne and Newman (1940), Graham and Kerr (1941), and in the Navy by Allison (1941). Possibly this may partly be explained by the fact that the series analysed by Payne and Newman included sick from France and it might be assumed that the minor

dyspepsias would be eliminated by the time the base hospital in England was reached whereas in the series under consideration here the majority of the dyspepsias were admitted direct from units and thus no elimination could be carried out by Field Ambulances or Casualty Clearing Stations. Graham and Kerr state that the cases in the series analysed by them were from Military Hospitals which were used largely for the investigation of dyspeptic cases sent especially for this purpose.

In the series under consideration here only 80 per cent had radiological examination as preliminary investigation and symptomatology did not suggest gastro-duodenal or organic disease.

In this group of ulcer patients 18 were duodenal in type. This percentage (56 per cent) is also much lower than that found by Graham and Kerr but the total number of cases considered is too small to be of any true statistical value.

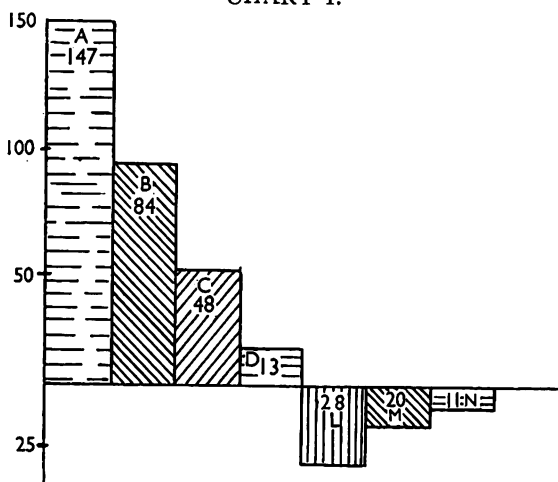
Twenty of the men in the peptic ulcer group gave a definite history of proven ulcer prior to military service either by positive X-ray findings or by operative procedure in civil life. Only three men gave a symptomatic history of gastric upset starting within their period of Army service.

Table I shows the distribution of the ulcers and relation to previous history.

TABLE I

<i>Site of Ulcer</i>	<i>No. of Cases</i>	<i>Positive History Prior to Service (X-ray or Operation)</i>	<i>Symptomatic History Prior to Service</i>	<i>Symptomatic History since Service</i>
Duodenum ..	18	10	16	2
Pylorus ..	2	1	2	0
Pre-pyloric ..	4	2	3	1
Body of Stomach ..	6	5	6	0
Jejunal ..	2	2	2	0
TOTALS ..	32	20	29	3

CHART I.



Only one of these patients gave a history suggestive of hæmatemesis and as further investigation of this case did not reveal definite proof of ulceration it is not included in the series tabulated.

The only other case of alleged "hæmatemesis" admitted was found to be a confirmed drinker of beetroot wine. This case well illustrates the necessity of adequate history taking.

As already stated fractional meal tests were usually done as a routine on the day following admission and 147 out of 150 cases had this done. The foregoing chart shows the incidence of abnormal findings in relation to definite diagnosis.

The term hyperacidity is used to denote all degrees from moderate to marked hyperchlorhydria and similarly hypoacidity is used for both moderate and for achlorhydria.

A.—Total No. of F.T.Ms.

B.—No. with hyperacidity.

C.—No. with hyperacidity and occult blood in stool.

D.—No. with hyperacidity and occult blood in stool and proven ulcer.

L.—No. of cases of "Gastritis."

M.—No. with hypoacidity.

N.—No. with hypoacidity and occult blood.

The test used for occult blood was the Benzidine Test and the findings in the chart are those of the original test.

The highest incidence of proven ulcer cases was in the age group 25-35 years. Duodenal ulcer tended to occur at the upper limits of this age group while pyloric and pre-pyloric ulcer types were usually found in younger men. This is only of passing interest as the period when hospitalization occurred had, in the majority of cases, no relationship to the onset of the actual ulceration. This period is almost impossible to ascertain with any accuracy except in cases where the onset was sudden (as in perforation) but a history of 5-7 years was a common finding in this group.

Of more importance from an Army medical aspect is the length of service prior to hospitalization. If the service (twelve years) of one Regular Serjeant with a three years' intermittent history is omitted the average effective service of men in this group is eight months. Duodenal ulcer patients on the whole broke down earlier than other types. The two patients with jejunal ulceration both served fifteen months before being warded.

Distribution in units was as follows: Infantry, 11; R.A.S.C., 8; Pioneer Corps, 7; R.A., 3; R.E., 3.

It is interesting to note that during the same period the Surgical Staff dealt with four cases of perforated ulcer. These were all duodenal in site and two of the cases (both in young men of about 26) gave no previous history of gastric trouble. These cases are not included in the series.

No definite conclusions could be drawn from so small a series but taken in conjunction with similar findings by other writers on the subject the following points can be made:—

(1) That although Army diet in itself does not appear to be a potent predisposing cause of peptic ulceration the breakdown of men with a previous peptic ulcer history is only a matter of time.

(2) That a more particular examination before enlistment (particularly in men with evidence of operative interference) would in the end be an economical and time-saving advantage. Personally I do not consider a man with a gastro-enterostomy as likely to be fit for military service.

(3) That, owing to the length of time required for satisfactory treatment (Spriggs) and the known frequency of recurrences, peptic ulcer cases should be invalided out of the Service unless the man holds special qualifications and has a reasonable chance of maintaining some form of dietary (i.e. officers and senior N.C.O.s.).

The following case illustrates the economic liability that an ulcer case can be. Lance-Corporal E., aged 27, Pioneer Corps, service four months, admitted to hospital December 23, 1940, with a three years' history of intermittent attacks of gastric upset. Present attack of five months' duration consisted of pain two hours or so after a meal—pain eased by alkalies but not relieved until he had taken the next meal. A fractional test meal revealed a moderate degree of hyperacidity and the stool contained no occult blood. A barium series X-ray revealed deformity and tenderness of the duodenal cap and he was diagnosed as a case of duodenal ulcer. He responded well to diet and alkalies and was discharged January 22, 1941, on fourteen days sick leave. He was re-admitted May 22 with recurrence of symptoms (one month's duration). Fractional test meal curve was almost identical with the December curve but the stool now contained occult blood. He was invalided out of the Service and discharged from hospital June 10, 1941. His total service was nine months, nine weeks of which service either spent in hospital or on sick leave.

B.—GASTRO-DUODENAL IRREGULARITIES.

This was a small group of seven cases: (a) duodenal diverticulum, 2; (b) duodenitis, 5.

All these men gave a symptomatic history suggestive of duodenal ulceration—the history being of fairly long standing.

In (a) radiological examination of both cases revealed a patent diverticulum of the duodenal cap. In one case there was diverticulum cicatrization indicative of healed erosion while the other case had definite tenderness of the diverticulum suggestive of present active erosion. Both cases had hyperchlorhydria.

In (b) radiological examination although not revealing an ulcer crater or duodenal deformity showed the duodenum to be very irritable and tender.

C.—GASTRITIS.

This group was fairly well marked as a clinical entity and in the series twenty-eight cases (18 per cent) were so diagnosed. The majority of these presented a history of vomiting immediately after meals and had varying degrees of hypoacidity. Three cases with ulcer-like symptoms and hyper-

acidity were found on X-ray to have a hypertrophic gastritis. Two men are included in this group—diagnosed as acute gastritis. Their symptoms were of sudden onset and transitory and were associated in both cases with a recent indiscretion in diet. In five of the cases the gastritis was associated with a chronic bronchitis, the chest symptoms being of longer duration than the gastric.

D.—DYSPEPSIA.

This large group of indefinite dyspepsia which has no counterpart in any of the recent analyses may roughly be divided into two classes.

(1) Those dyspeptics where investigation revealed some abnormality which may possibly have been the cause of their symptoms.

(2) Those men on whom investigation failed to reveal any gross abnormality.

Class I. Probable Organic Lesions.—In this class are placed (a) men whose symptoms were suggestive of ulceration but in whom investigation did not reveal definite radiological evidence (nine cases)—(b) men whose dyspepsia was associated with appendicular disease either at a former investigation or at the time of their admission (four cases).

The following case is an example:—

Driver S., R.A.S.C., aged 29—admitted to hospital April 23, 1941, with a history of indigestion since 1936. Previous investigation in 1937 for similar symptoms although not revealing peptic ulceration had led to the removal of his appendix. He had been free from symptoms for several months after this operation. On examination he was found to be still tender in the right iliac fossa and palpation revealed a "lumpiness" in the region of the scar. Investigation failed to reveal any ulceration but there was indication, on radiological examination, of some abnormality in the appendicular region. A laparotomy was performed by Major Wilson and mesenteric adhesions freed from the scar tissue. He made a good recovery, took ordinary diet without complaint and was discharged June 12, 1941, to sick leave.

Atonic Dyspepsia.—In this class is also included another group of dyspepsia whose cause may be secondary to an atonic or ptosed stomach. There were fourteen such cases. It is doubtful whether atony in itself would give rise to digestive symptoms especially pain (McNee and Smith) but as fractional test meal and occult blood findings were not consistent in this group of cases it has to be regarded as a factor.

Gastric Neurosis.—That psychological factors may have an influence in ulcer production is well known and this fact is borne in mind when it is assumed that varying degrees of mental upset will, in certain individuals, produce varying degrees of gastric neurosis; thus in the group of dyspepsia of probable known causes twelve cases have been included which were diagnosed as nervous dyspepsia.

As in the previous group fractional test meal and occult blood findings vary. The diagnosis could usually be made from observation of the patient while in the wards under treatment and on his reactions while undergoing the radiological examination. In a few of the cases a psychiatric opinion

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was available. Air swallowing was common in this type of patient. Vomiting was always one of the symptoms but actual vomiting while in hospital was rare and the general condition of the men was excellent in spite of their story of persistent vomiting. That the neurosis could be of extreme degree is shown by the following case.

Gunner, W., aged 26—admitted to hospital December 30, 1940, with a history of gastric trouble since his schooldays. He had been in Civil Hospitals on two occasions—once while on privilege leave. His chief complaint was burning pains in his stomach after food and vomiting. Examination revealed no gross abdominal abnormality and his weight on admission was 122 pounds. Investigation revealed only a moderate degree of hyperacidity and there was no occult blood in the stool. His symptoms persisted while under dietetic treatment and he appeared to be able to produce a watery vomitus at will. Radiological examination was negative. It was explained to him that there was no serious gastric trouble but in spite of a strict diet his symptoms remained. Gastric lavage was tried without any improvement in his condition. The fractional test meal was repeated but the findings did not show much variation from the original. He was again X-rayed and no organic lesion was discovered although the radiologist reported him as a "functional type." He was eventually seen by the psychiatrist and diagnosed as chronic hysteria, being invalided out of the Service as such and finally discharged from the ward on April 21, 1941, his weight being 121½ pounds.

Class II.—Included in this group were forty-four men or 30 per cent of total admissions.

Clinical examination and preliminary investigations in a number of these cases did not suggest organic disease and response to dietetic treatment was, on the whole, fairly good. In other cases full investigation was entirely negative. Possibly a number of these men may be latent cases of peptic ulcer or other organic disease and others more probably belong in the neurotic group but, as actual evidence is lacking, they have been placed in this unsatisfactory class. Disturbance of digestive processes by change to Army food could not be the sole cause of their trouble as the majority of men in this class had several months' service prior to admission. Perhaps the solution of the cause of their dyspepsia may be found later as these men are prone to re-admission. However in three such cases recently re-admitted on account of return of symptoms re-investigation failed to show evidence of organic trouble.

SUMMARY.

In 150 cases admitted 32 (22 per cent) had radiological evidence of peptic ulceration. 56 per cent of these ulcer cases were duodenal in site—these figures both being much lower than with other writers. Twenty of the men in the peptic ulcer group had a positive history of ulceration prior to Army service. There was no history of serious complications during Army service and the average service before hospitalization of men in this group was eight months.

No cases of gastric carcinoma were encountered.

Two other definite groups were outlined, gastro-duodenal irregularities—seven cases; and gastritis—twenty-eight cases; leaving a large indefinite group of eighty-three men classified as dyspepsia.

In this group sufficient evidence was available to regard thirteen of these patients as having a possible gastro-intestinal organic lesion while fourteen of the men had a definite atony of the stomach and were diagnosed as atonic dyspepsia. Twelve cases of gastro-neurosis were diagnosed. This leaves forty-four dyspeptics or 30 per cent of total admissions in which investigation did not reveal any gross abnormality to account for their symptoms.

I am indebted to (1) Lieutenant-Colonel B. E. Schlesinger, R.A.M.C., O.C., Medical Division, for his help in compiling the above narrative. (2) Major N. H. Martin, R.A.M.C., for undertaking the chemical and biological analyses carried out during the investigations. (3) Major A. C. Sinclair, R.A.M.C., for the radiographic work in connexion with the investigations. (4) Colonel R. A. Anderson, M.B., F.R.F.P.S., for permission to send the above notes for publication.

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MALIGNANT DISEASE OF THE TESTIS.

WITH THE REPORT OF A CASE OF SEMINOMA, PRESENTING A PROBLEM OF DIAGNOSIS.

BY MAJOR S. NEWSOM, M.B., F.R.C.S., EDIN.,

Royal Army Medical Corps.

MALIGNANT disease of the testis, a condition of some rarity, always presents features of clinical interest. The case outlined below is mainly of note since the diagnosis before operation was not clear although the balance of probability inclined in the direction of malignant disease.

The patient, an aircraftsman, aged 24, was referred to me by Squadron-Leader J. E. M. Barnes on October 24, 1940. He gave me the following history:—

He had had a lump the size of a cherry in the centre of his right groin since childhood. It had never caused him any pain or inconvenience nor had it entered his scrotum at any time. At his examination by a Civil Medical Board at Edgware on May 30, 1940, he had been told that it was an undescended testis. He was passed in Grade II. No mention is made in his Medical History Sheet of the reason but, in addition to the undescended testis, there was a tachycardia of 112 per minute. This was probably of nervous origin since at later examinations and during his stay in hospital he showed no sign of this condition. At Uxbridge he was examined by a medical officer of the R.A.F. in July, 1940, where again the diagnosis of undescended testis (right) was made.

Two weeks prior to my examination on October 24, 1940, he had noticed at lunch time an increasing discomfort in the right testis. On retiring at night self-examination revealed that there had been a sudden increase in the lump of considerable magnitude together with a change in its position. He was unshakable in his statement that the increase had taken place within a few hours.

There was by this time marked soreness in the groin with tenderness in the lump. During the two weeks it had, he thought, increased slightly in size, become more tender and affected his right thigh, which was the seat of dragging pain and tiredness. He had not vomited. Nausea was present when he handled or jarred the swelling. There was no abnormality in his urinary system. The bowels were regular and no alteration of daily defæcation had been noted.

There was no history of trauma, either by blow or strain; no history of venereal disease was admitted. Previous and family history were negative.

Examination.—Examination revealed a large rounded solid lump roughly 3 by 2 inches in the right groin lying under the skin over and to a greater extent below the external ring. It was not fixed to the skin or superficial tissues. Although relatively immobile nevertheless it could be moved slightly in all directions, giving the impression of being held by a tight deep pedicle. There was a small amount of fluid at its inner end but the general mass was smooth, solid and tense. It did not transilluminate. Continued handling of the tumour caused a minor degree of nausea accompanied by

some pain radiating down the inner side of the thigh. The right side of the scrotum was empty and atrophied. The left testis was normal.

There were one or two small shotty glands in both groins. Rectal and abdominal examinations were negative. The heart and lungs presented no abnormality. The pulse rate was 84 per minute.

Neither a Wassermann reaction nor an Aschheim-Zondek or Friedmann's urine test was undertaken.

On consideration it seemed that the diagnosis lay between the following conditions:—(1) A hæmatocele; (2) a hydrocele; (3) an incarcerated hernia; (4) subacute torsion of the spermatic cord with a resultant torsion of an undescended testis; (5) malignant disease of the testis with a sudden increase in the size due to hæmorrhage.

The first three conditions were only considered to be dismissed forthwith since there was no history to account for a hæmatocele, a hydrocele would have been translucent and a hernia would not have presented a smooth surface had its contents been omentum; it could hardly have failed to provide some intestinal symptoms had its contents been gut.

The last two conditions—torsion and malignant disease—required more thought. Although the lack of any trauma, direct or indirect, and the absence of initial nausea or vomiting was against its being twisted, yet the tenderness of the lump and its extremely rapid increase in size, from a cherry to a hen's egg, supported this contention. Further, the condition is said to be more common in an undescended testis than one in its normal position.

Finally the diagnosis of malignant disease was supported by the avowed presence of an undescended testis of arrested development. The physical properties of the swelling, with a concomitant small secondary hydrocele, were in keeping. The rapid increase in size, a point which no amount of questioning could shake the patient, was unusual for a hæmorrhage. Also its change in position from mid-Poupart to the pubic region did not find a ready explanation.

In an attempt to make a pre-operative diagnosis it was finally determined that the weight of evidence favoured a condition of malignant disease with the reservation that it might well be a spermatic cord torsion. Tuberculosis and spermatic and other cysts were not even considered.

On October 28, 1940, he underwent an operation under open chloroform-ether anæsthesia and incision was made 3 inches long axially from the lower end of the swelling to a point over the inguinal ring.

A large swelling $3\frac{1}{2}$ by $2\frac{1}{2}$ inches consisting of an enlarged testis covered by a tunica vaginalis containing a small quantity of fluid was disclosed. The tunica was incised, a few c.c. of clear watery fluid being present. The external oblique aponeurosis was divided up to the internal ring; the cord, the vessels of which were not noticeably enlarged, was divided as high as possible between ligatures, the upper of which was reinforced by a second guard. All bleeding points having been secured, the aponeurosis was sutured and the wound closed without damage.

Despite his enforced evacuation to another hospital on the eighth day, due to enemy action, he made an uninterrupted recovery. On his twenty-first day he was discharged to twenty-one days' sick leave.

The accompanying illustration, taken within an hour of operation, shows the testis divided down its long axis. The epididymis is not visible, being posterior, nor is the cord which was only $1\frac{1}{2}$ inches long. On section the

tumour mass swelled out; there were no patches of hæmorrhage. The cut surface showed a strong resemblance to a fibro-adenoma of the breast.

The specimen was submitted to Lieutenant-Colonel F. J. Hallinan, R.A.M.C., Officer in charge of a Command Laboratory, who reports as follows:—

Specimen.—Testis, epididymis and cord (right).

Naked Eye Appearance.—Testis $2\frac{1}{2}$ by 2 by 2 inches. On section the whole of the testis seems to have been replaced by a lobulated tumour mass without cystic formation.

Microscopical Sections.—Section through centre of testis. Tissue is composed of dense strands of fibrous tissue enclosing irregular masses of medium sized spheroidal cells in loose thin stroma. These cells have deeply staining nuclei and only a thin rim of cytoplasm. Some of the nuclei show mitotic changes. These cells are arranged in loose clumps with a slight suggestion of tubule formation and in long columns permeating the



strands of fibrous tissues. They bear some resemblance to the cells lining seminiferous tubules. Scattered among these tumour cells are a few giant cells containing a few faintly staining nuclei.

Opinion.—Carcinoma (seminoma) of testis.

Section Across Vas Deferens.—No sign of permeation of vas by tumour cells.

Section Through Epididymis.—Appears normal, no sign of tumour cells.

On his return from sick leave he was transferred on December 28 to an R.A.F. Hospital for continuation of treatment. He was seen by Wing Commander (now Group Captain) Stanford Cade. It was noted here that the scar was well healed. A few shotty glands were present in the left supraclavicular region and axilla. There was tenderness in the lumbar region but no mass was present. He was transferred by Group Captain Stanford Cade to the latter's department at Westminster Hospital for prophylactic X-ray therapy to the regional lymph nodes.

Under the care of Dr. F. M. Allchin, Physician in charge of Radiotherapy, Westminster Hospital, he underwent a course of X-ray treatment from January 7, 1941, to March 6. During this period it was found necessary to withhold treatment on account of the state of his blood, which showed very marked lymphopænia.

The areas treated were right and left inguinal regions and the pre-aortic glands from two anterior and two posterior fields. The fields were in all cases K.V. 200, F.S.D. 50 cms., with filter at first Thoræus and later 2 mm. Copper.

The skin dosage was 1,700v. units to each posterior field.

The dosage was not up to the usual figures given on account of the extreme sensitivity of the skin.

On March 7 he was readmitted to the R.A.F. Hospital for further examination. It was reported that the operation scar was soundly healed. There was no evidence of enlarged glands on abdominal examination. An X-ray of the chest showed both pulmonary fields to be normal. Following the X-ray therapy there were four areas of erythema which should subside in three to four weeks. He was transferred to a convalescent depot for twenty-eight days.

On April 12 he returned to duty, since which time he has been on full work as an ambulance driver. I saw him on May 8, eight months after the operation, when he declared he was well except for some occasional right-sided headache. Examination revealed a deep but indefinite mass to the right of and just below the umbilicus. He was due to return in one week to the R.A.F. Hospital for further examination, which has since been carried out. I have examined him again and find no mass. He is symptom free.

This case is a source of interest in two main directions—the differential diagnosis and the type of tumour.

The pre-operative diagnosis was not to be reached with ease. Malignant tumours of the testis are rare. In fifteen years of continuous surgical practice I have seen three cases; of these one had previously undergone orchidectomy and showed no signs of lung involvement.

F. J. F. Barrington [1] quotes 9,714 male in-patients admitted to St. Paul's Hospital, with only 14 cases of malignant disease of the testis, a percentage of 0.13.

Personal communications from colleagues undertaking general surgical practice show that the usual number seen by general surgeons as against those in special hospitals is limited to single figures over a span of years.

Had the tumour presented the usual diagnostic history of painless swelling of the testis with uniform rate of increase, perhaps interspersed with exacerbation due to hæmorrhage, together with an absence of tenderness on examination, the diagnosis might have been reached with more certainty. The weight of the organ in this and all similar cases of undescended testis is of importance

There seems to be some difference of opinion as to the frequency of occurrence of malignant disease in an undescended testis as against one in its normal position. Barrington [1] states that the undescended testis is the more liable, whilst J. G. Ainsworth Davis [2] questions the truth of this assertion. McCutcheon, quoted by R. E. Smith [3], reviewing the question of undescended testis in 1,656 boys over 15 years of age, found the testis undescended in 13—i.e. 0·8 per cent—whilst in the same paper Pace and Cabot stated that they had seen 3 cases of adenocarcinoma (seminoma) in 24 undescended testis. Smith concludes on his own and other statistics that the risk of malignancy is a very real one and explains that the apparent disagreement is to be found in the age at which the testis is removed. The longer the testis is left after puberty without the patient submitting to orchidectomy the greater the risk of malignancy.

Malignant tumours of the testis are divided into two groups—the embryonal type or teratoma and the adult type or seminoma. The former arise from any one or more of three primordial types of cell. Representatives of all three types are usually to be found with a predominance of one layer; thus epiblast gives rise to a teratogenous chorion-epithelioma, mesoblast a teratogenous sarcoma and hypoblast to a teratogenous carcinoma. These tumours are characterized by a more rapid rate of growth and with the occurrence of hæmorrhage into the growing tumour, this latter feature being especially common in, although not by any means confined to, the sarcomatous type. There are the tumours of adolescence and young manhood occurring most commonly up to the age of 25 to 30. They are the modern names for what was formerly described as sarcoma and fibro-cystic disease of the testis.

The seminoma is a carcinoma arising from the spermatocyte or seminiferous epithelium. It is also known as a spermatocytoma. It is less malignant than the teratoma, being of slower growth and later in giving rise to metastases. It usually gives a longer history. It is the tumour of adult-middle age, usually to be found in the 30 to 50 decades. The seminoma is of more frequent occurrence, occurring in 75 per cent as compared to the teratomas 25 per cent case incidence.

This last statement has some bearing on the case described. On the grounds of age and arrested development in the organ the type of tumour to be expected would be the adolescent teratomatous type where in fact the adult seminoma or true carcinoma was found. Carcinoma can occur elsewhere in the body at all ages but the great preponderance of age occurrence is in the later decades. That a seminoma should occur at the age of 24 is just as reasonable as the finding of a carcinoma of rectum or stomach which is not uncommon in this decade. There is, however, one factor not to be found, other things being equal, in other organs, which is present in the case of an undescended testis. The undescended testis after puberty always tends to atrophy resulting in some amount of increased fibrosis. This, together with the fact that the less developed or more embryonal cells will tend to

have a shorter life and be more readily obliterated by fibrous overgrowth in such circumstances, may explain the occurrence of this type of tumour.

I think the explanation of the sudden increase in size "from a cherry to an egg" during a period of hours is to be explained in the following way:—Despite his positive assurance that there had been no increase in size until the day of its discovery yet, in reality, the testis had been gradually enlarging for some time. Its position in the canal would allow a comparatively slow growing tumour to take the line of least resistance. The internal oblique and conjoint tendon would offer less resistance than the more fibrous external oblique aponeurosis which in this case was particularly well developed. During the morning of the day of its presentation under the skin he had sustained some trivial unnoticed strain causing it to be herniated through the external ring which had partaken of the slow dilation present in the inguinal canal. Once having left its tunnel the external ring acted as the neck of a strangulated hernia and did not allow of its return.

Treatment of malignant disease of the testis may be pursued on one of two lines. The first is by radical operation in which the testis and cord together with the glandular drainage area up to and including the pre-aortic glands are removed. This is a heroic and prolonged undertaking made through an enormous incision. It is always attended by considerable shock. The immediate results show a high rate of mortality and the late results seem no better than the second and infinitely simpler and safer procedure of orchidectomy with removal of the cord up to the external ring followed by radiotherapy. The radical operation has been abandoned by all but a few surgeons.

There is a third and by far the most important line of treatment in the case of undescended testis for which I would advance a plea. If it be accepted that an undescended testis carries with it any increased risk of malignancy, and the other be descended and normal, then surely it is logical to remove the offender. The point arises as to the optimum age for the performance of operation. After puberty the undescended testis does not usually come down. Further should it be replaced by a plastic operation the chance of its usefulness other than as a provider of internal secretion is at least doubtful. Hence I suggest that it is a rational undertaking to perform the simple operation of orchidectomy, dealing if necessary with the common concomitant, a hernial sac, in all cases of undescended testis after the sixteenth year.

SUMMARY.

A case of seminoma of an undescended testis in a young adult is described.

The differential diagnosis is discussed particularly in relation to the curious history and clinical findings in the case.

A brief note of the pathology of malignant testicular tumours is given and the question of treatment is raised. A plea is advanced for the more

frequent performance of orchidectomy in unilateral undescended testis at the age of 16+ on prophylactic grounds.

I wish to tender my thanks to Major P. G. Touhy, R.A.M.C., Officer Commanding a Military Hospital, for affording me permission to publish the above notes; to Lieutenant-Colonel F. J. Hallinan, R.A.M.C., for his pathological report and helpful suggestions; to Group Captain Stanford Cade, R.A.F.M.S., for permission to use his notes and for his interest; to Squadron Leader J. E. M. Barnes, R.A.F.M.S., for his active assistance and continued support; and Dr. F. M. Allchin for details of the radio-therapeutic treatment.

Finally my thanks are due to Serjeant J. Boshier, R.A.O.C., who has shown much patience and cheerfulness in the midst of a mass of technicalities.

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HISTOLOGICAL FINDINGS IN FATAL CASES OF BACILLARY DYSENTERY.

BY MAJOR JOHN C. DICK, M.D.,

Royal Army Medical Corps.

INTRODUCTION.

A HISTOLOGICAL examination of various organs from fatal cases of bacillary dysentery in the Middle East was commenced in January, 1941, and the following is a report of the findings for the period January 1 to May 31. Brief clinical notes are given in cases where they are of value in co-ordinating the histological picture with the course of the patient's illness.

GENERAL.

(a) *Incidence.*—Tissues from seventeen cases were examined and this number, as compared with the total incidence of bacillary dysentery for the period under review where the figures are available, is shown below under the different nationalities:—

	<i>Total Incidence</i>	<i>Fatal Cases</i>
B.T.E.	1027	5
N.Z.E.F.	376	1
Free French	-	1
Ps.O.W.: Italian	-	9
Libyan	-	1

Thus, in the first two groups, the death-rate was less than $\frac{1}{2}$ per cent.

(b) *Age.*—The age of the fatal cases varied from 22 years to 49 years, but was not stated in eight.

(c) *Bacteriology.*—The findings in this respect were:—

Isolations: *B. dysenteriae*, Shiga, 6.

B. dysenteriae, Flexner, 1.

B. dysenteriae, mannite-fermenting (non-agglutinating), 1.

Bacillary exudate } { even on repeated examinations, 4.

Indefinite exudate } { often including sigmoidoscopic swabs, 1.

No investigation, including two fulminating cases, 4.

(d) *Duration.*—As the onset of bacillary dysentery is usually sudden, the duration of the disease could be stated accurately in all of the cases and they fell into four groups:—

A. 1 week or under, 3, with one Shiga infection.

B. About 2 weeks (11-15 days), 4, with two Shiga infections.

C. About 3 weeks (19-21 days), 7, with two Shiga infections.

D. Over 4 weeks (47, 50, 70 days), 3, with one Shiga infection.

HISTOLOGICAL APPEARANCES.

Large Intestine (examined in sixteen cases). In sections of the colon from these cases, the whole range of acute, subacute and chronic inflamma-

tory changes was seen in the mucous and submucous coats. The inflammatory process was confined for the most part to the mucosa and superficial area of the submucosa yet it followed the lymphatics and blood-vessels to the deep area and occasionally for a short distance into the muscle layer. The ganglion cells of Auerbach's plexus were frequently involved in this perilymphangitic inflammation, probably explaining the increased irritability of the colon. Sections from only two cases of the series showed general extension of the inflammation into the muscle with oedema, cellular infiltration and changes in the muscle fibres.

The presence of numerous large macrophages was a very prominent feature of the inflammatory exudate. These cells appeared at an early stage in the acute ulcers and were still numerous in the granulation tissue of chronic lesions. In a few cases, they were present under the peritoneum, where an early peritonitis was found. Their size varied from slightly larger than a plasma cell up to 30 to 40 μ in diameter and many contained several red cells and polymorphs plus fragments of others.

Even when desquamation of the mucous membrane was very extensive to naked-eye examination a few tags of epithelium were seen histologically and desquamation of much of the submucosa was rare. In two cases, however, there were areas of desquamation extending right down to the surface of the muscle. In the chronic ulcers, the submucosa was represented by a thick layer of granulation tissue with numerous young capillaries and fibroblasts and a narrow superficial layer showing infiltration of polymorphs, plasma cells, macrophages and lymphocytes.

Congestion of the blood-vessels was very marked and interstitial hæmorrhages were frequent. In the fulminating cases, the presence of preformed thrombi in the veins was striking and was probably responsible for changes in the liver and spleen. In one case of the series, the immediate cause of death was repeated severe hæmorrhage from the colon as a result of these congested and dilated vessels being exposed by the desquamation and, in another case, hæmorrhages played a prominent part in the fatal termination.

The ulceration of the colon was generally more marked in the lower part—sigmoid and rectum—but, in two cases, the cæcum and ascending colon showed more chronic changes and evidence of healing while acute lesions were developing at the lower end.

Small Intestine (examined in thirteen cases). Three cases showed acute inflammatory changes in the terminal ileum, four showed merely congestion and there was no change in the rest.

Peritoneum.—Changes here varied considerably but were not a consistent feature. In ten cases, no abnormality was found post mortem or histologically (in sections of the bowel). Five cases showed early acute inflammatory lesions, in another case a pint of blood-stained fluid was found in the cavity and, in the seventeenth case, pelvic peritonitis was present with two pints of clear fluid and inspissated fibrin flakes.

Mesenteric Lymph Nodes (examined in three cases). Enlarged nodes

showed the typical picture of sinus catarrh, with macrophage activity developed to a very pronounced degree.

Liver (examined in eleven cases). No changes due to the dysentery were found in seven cases. In three of the others, fatty change with some necrosis of the liver tissue was present, advanced in two and only slight in the third; these cases were of long duration and the lesion could not be considered specific. A specimen of liver was obtained in only one of the cases of short duration. Sections showed small areas of necrosis with macrophage infiltration scattered throughout the organ, probably due to small emboli from the vessels in the wall of the large intestine.

Spleen (examined in thirteen cases). This organ consistently showed the changes usually found in acute septic conditions, i.e. congestion of the pulp and reticulo-endothelial activity. In one fulminating case small areas of necrotic tissue were present in some of the Malpighian corpuscles, due to the same cause as the necrotic areas in the liver of the same case.

Suprarenals (examined in fifteen cases). No histological change was present in this organ. In one case, a gross hæmorrhage was found in the left suprarenal.

Heart Muscle (examined in eight cases). No special lesions were found here. In two cases, both of long duration without sudden death, fragmentation and segmentation of the muscle fibres was seen. The capillaries of the skin and subcutaneous tissue showed no histological abnormality.

Thus the circulatory failure which developed terminally in many of the cases was a functional one and not due to any specific lesion in the heart or small blood-vessels.

Kidney (examined in fifteen cases). In describing the lesions in this organ, the cases will be considered in groups according to the duration of the disease and emphasis will be laid on cases due to proved Shiga infections.

A.—Duration of One Week or Less.

The case of Shiga infection in this group developed bilateral bronchopneumonia and died in seven days. His kidney showed patchy glomerular congestion and catarrhal changes in the tubules, of no specific importance in a patient with severe toxæmia.

B.—Duration about Two Weeks.

In one of these cases, an Italian aged 49, the glomeruli showed increase of size and cellularity with thickening of the capillaries and occasionally reduplication of the capsular epithelium. The tubules showed various stages of degeneration most marked in the convoluted and least marked in the collecting parts. This picture was very suggestive of an early glomerulonephritis. In the other Shiga infection post mortem autolysis was very marked and obscured what appeared to be a similar finding.

In a case of this group, in which the causal organism was not isolated.

there was definite acute glomerulonephritis affecting chiefly the capillaries of the tuft—"intracapillary." This case collapsed on the fourteenth day of his illness, his tongue was dry and coated, hiccough developed and he passed into a state of coma vigil. Next day his pulse became rapid and poor, he became semiconscious and died. The syndrome suggested uræmia.

C.—Duration about Three Weeks.

An Italian, aged 28, admitted to hospital on the eighteenth day of his illness in a collapsed condition with albuminuria, died two days later. *B. dysenteriae* (Shiga) was cultured from the colon post mortem. The kidneys showed widespread damage, with increased size and cellularity of the tufts, some with intense congestion, many with reduplication and desquamation of the capsular epithelium. The first convoluted tubules were necrosed or showed extensive cloudy swelling, while the epithelium of the other tubules was not affected although granular or hyaline material was often present in the lumen. This lesion indicated at least a very severe toxic reaction, possibly a genuine glomerulonephritis.

In another case of this group, where the causal organism was not isolated, the kidneys showed an intracapillary glomerulonephritis superimposed upon previous vascular damage. A third case gave evidence of an acute exacerbation of a chronic glomerulonephritis.

In the remaining cases the histological findings were not distinctive.

D.—Duration Over Four Weeks.

The case infected with Shiga in this group gave a very interesting history. After a fortnight's severe illness with diarrhoea, vomiting, weakness and toxæmia, his blood urea was 60 mgm. per 100 c.c. and he showed albuminuria which cleared up in a few days. He did not convalesce in the usual manner: his pulse-rate remained high and nausea and vomiting persisted. After a few weeks, towards the end of which œdema developed in his legs, he became disorientated, the pulse-rate rose still higher and he died on the forty-seventh day of illness. Post mortem, a low-grade peritonitis, with two pints of thin watery pus, was found. Histologically, the kidneys showed a generalized intracapillary glomerulonephritis at a late acute or early sub-acute stage. The colon showed the usual changes but there was nothing of note in the other organs.

Another case (Flexner infection) which persisted for seventy days showed a similar kidney lesion but patchy in distribution.

In the whole series, it could not be stated dogmatically that so many of the cases showed glomerulonephritis and so many did not. There were two reasons for this difficulty:—

(a) Accurate histological interpretation was impossible in some, owing to autolysis or to bad fixation of the tissues.

(b) The borderline, histologically, between appearances due to severe

toxæmia and those which can be called frank glomerulonephritis is very hard to determine. Assistance in recognizing the latter was given in several cases of this series by a sufficient clinical history.

KIDNEY LESIONS IN NON-FATAL CASES.

The following brief notes of two cases, out of a series of 234 (seven Shiga infections) with no deaths, show that a kidney lesion occurs in bacillary dysentery in cases which recover but obviously, in one of them, the organ has suffered very severe damage.

(i) Patient, aged 22, Shiga infection. On the twelfth day of illness, slight generalized œdema developed with suppression of urine for twenty-four hours and the temperature rose to 104°. Next day, the urine showed albumin (less than a half part Esbach), hyaline and granular casts, polymorphs and epithelial cells, and paracolon bacillus on culture. His temperature fell and rose again in the next few days but it, and also the œdema, had settled by the sixteenth day although there was still a trace of albumin in the urine with scanty granular and hyaline casts. Thereafter, all the signs disappeared and the urine was completely normal by the twenty-third day.

(ii) Patient, aged 23, report on fœces examination—bacillary exudate (causal organism not isolated)—but at the end of the seventh week of illness a culture of *B. dysenteriae* (Shiga) was agglutinated by the patient's serum in a dilution of one in fifty. This patient was admitted with severe toxæmia and had a copious hæmorrhage from the bowel on the ninth day of illness. At this time his urine was free from albumin. On the twenty-second day he became drowsy, his heart was enlarged, arthritis developed in both shoulders and elbows and his general condition was very poor. Next day there was a considerable amount of albumin in his urine (four parts Esbach), numerous hyaline and granular casts, red and white cells and epithelial cells, but no growth on culture. The blood urea was 64 mgm. per 100 c.c. On the twenty-fifth day there were seven parts Esbach albumin in his urine, casts and cells not quite so numerous. By the thirty-second day his general condition was greatly improved, his blood urea down to 30 mgm. per 100 c.c. and albuminuria to one and a half parts Esbach, granular casts scanty. One week later the blood urea was 35 mgm. per 100 c.c., albuminuria one part Esbach, casts again numerous. Clinically, this case was considered to be an exacerbation of previous damage.

COMMENTS.

From the results obtained so far in this investigation, the main interest lies in the discovery of nephritic lesions in a considerable proportion of these fatal cases of bacillary dysentery. Pyelonephritis due to *B. coli* has been reported (Manson Bahr, 1940) as a complication of this type of dysentery and a similar condition due to *B. dysenteriae* of all three strains (Shiga, Flexner and Sonne) by Neter and Fisher, 1938. But no accounts of the disease (with one possible exception—Wauke, 1938) describe the occurrence of glomerulonephritis. It has been shown above that this complication may develop, usually at the end of the second or third week, and is very probably due to the toxæmia which is most severe in Shiga infections (Rogers and

Megaw, 1939). The nephritis may contribute materially to the individual's death in the acute stage by causing uræmia. It may develop gradually, masked by absence of the usual gradual convalescence of the dysentery, and death occur in the subacute stage. In non-fatal cases, lesser degrees of kidney damage may be caused with either complete recovery or the danger of serious illness in later life.

Another point is the occurrence of emboli to the liver and spleen in the fulminating cases. From two cases more recent than this series, it has been found that these emboli may also go to the lungs and cause hæmorrhagic infarcts and bronchopneumonia, which is another common complication in fatal cases of bacillary dysentery.

SUMMARY.

The histological findings in a series of seventeen fatal cases of bacillary dysentery have been described.

The occurrence of glomerulonephritis as a complication was noted in several of the cases. It was shown that a similar condition occurred in a few cases which recovered.

N.B.—These cases died before the general introduction of the sulfaguani-dine treatment for serious cases of bacillary dysentery and none of the series was given the drug early in their illness. Two were given large doses in the later stages but, by that time, in each case, the kidney was already damaged. Several of the series were given large doses of anti-dysentery serum from the beginning, apparently without effect on the development of the kidney lesion.

ACKNOWLEDGMENTS.

The author wishes to express his thanks to Colonel J. S. K. Boyd for initiating this investigation and to the pathologists and other medical officers who supplied the material for histology and the clinical notes.

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Editorial.

CHANGES.

CHANGES in names of things may be settled in a moment. Alterations of a more fundamental kind take place much more slowly but are often anticipated and, perhaps, partly brought about by changes of name. We recall the *second* great change in the Medical Services of the Army—a change of name—the amalgamation of the officers of the Army Medical Department and of the Warrant Officers, non-commissioned officers and men of the Medical Corps into one great branch of the Army under the name of the Royal Army Medical Corps. The *first* great change had been one of organization; the medical officers of regiments had been withdrawn from their units and posted to military hospitals, junior officers being attached to one or more battalions to carry out such duties as the “morning sick” parade, sanitary inspections of barracks and other routine work. This change, no doubt, had been severely felt both by the officers concerned and by their regimental units because it was fundamental and greatly affected many individuals.

When we joined, at Netley, senior officers used to describe to us the old days when every uniform in the British Army was to be seen in the Mess; and we are still reminded of past times by an old retired combatant who vows that, with the taking away of medical officers from their regiments, the last trace of efficiency of the Medical Service was banished for ever! This alteration being one of a fundamental kind, as we have said, was deeply felt; but not so the amalgamation of officers and men into a Corps. Some of us were attached to regiments when the change came; others were in Field Ambulances or serving in military hospitals. The men had been doing certain duties and continued to do them. We enjoyed the change of title from Surgeon-Lieutenant to Lieutenant and the men, too, liked to feel that their officers were now in the same “show” as they were, but the change was one of name only and really meant very little to junior officers and other ranks. We recollect one slight misunderstanding—an Indian railway official was puzzled by the initials R.A.M.C. on our baggage and concluded that it stood for Royal Artillery, Mhow Contingent, and we remember rescuing it from the kit for Mhow with difficulty—but that was the sort of slip that might have been expected!

And yet the alteration in our title meant a great deal to us if we had only known it and a great deal, also, to the Corps. Perhaps we juniors were not sufficiently alive either to the great honour which had been conferred on us by Her Majesty Queen Victoria or to the real alteration in status that was implied in the change.

The South African War was to follow with the need to summon to the aid of the small number of regular officers a large contingent of civilian medical men, many of whom remained on in the Corps after the war. And then, after a period of quiet growth, the Great War of 1914-1918 burst upon us and found us more or less prepared. Now we face a second challenge and the Royal Army Medical Corps fills a gap which would have been unfilled under the "regimental system" or a system involving a Department for officers and a separate Corps for other ranks. Whether Regulars, Territorials or Temporary officers, whether skilled men called to the Colours because of the nature of their occupations or General Duty Orderlies, we all serve to the best of our ability in the Royal Army Medical Corps and find it a satisfactory job.

What will be the next change? Amalgamation with the Royal Naval Medical Service or with the Royal Air Force Medical Service? We think not. If any change is found necessary during the war it will be dictated by the need to make every medical officer conscious of the medical needs of civilians for the civil population has been very largely stripped of its doctors to meet the needs of the Services. That is a real problem. How are we to provide enough medical men to serve an Army that must soon be engaged in fierce fighting and yet leave sufficient to deal with the civilians?

Clinical and other Notes.

IMPROVISED RAFTS, PUNTS, AND BARGES.

BY LIEUTENANT-COLONEL E. A. CORMACK,

Royal Army Medical Corps,

AND

OFFICERS,

Of a Field Ambulance, R.A.M.C.

In action it may be necessary to cross a water obstacle, possibly without the immediate help from the Royal Engineers. In these notes methods are described for the construction of improvised rafts and punts suitable for ferrying casualties, stores, personnel and even vehicles across water, using only authorized Field Ambulance equipment.

I.—RAFTS AND PUNTS.

Many methods are already in use for floating single stretchers, including the use of the "Cover, rot proof canvas." As this has now been withdrawn from Field Ambulance G. 1098 equipment the following modification has been found suitable. To get a canvas of adequate size (10 feet by 6 feet), two smaller canvasses, such as the end curtains of a penthouse, are joined together end to end by rolling, the resulting rolled-joint being watertight.

(a) *A single-stretcher float* may be made by laying an open stretcher on the centre of the canvas, with a suspension bar fixed on each end. A penthouse rod is rolled in each edge of the canvas and the sides are lifted and tied on top of the suspension bars (figs. 1 and 2).

(b) *Two single-stretcher floats* placed parallel 2 feet apart and lashed together on top of two closed stretchers (one at each end) form a very stable raft, which will easily take three loaded stretchers laid across them.

(c) *The Stretcher Punt.*—A useful punt can be made with four stretchers and a large canvas, such as a penthouse cover. Two open stretchers, runners up, are placed in the centre of the canvas, with a pole through the runners. An open stretcher, runners inwards, is placed on each side at an angle of 60°. Adjoining runners are tied and a penthouse support fixed across each end at the top, being lashed firmly through the upper runners. Enclose the whole in canvas and tie firmly. This forms a very stable punt with good load capacity and is easily paddled with two G.S. shovels (figs. 2 and 3).

(d) *The Spare Wheel Raft.*—Four spare lorry wheels lashed together with two closed stretchers or baulks of wood form a raft capable of holding two stretchers (fig. 4).



1.—Single Stretcher Float, method of construction in foreground.



FIG. 2.—Single Stretcher Float and Stretcher Punt.

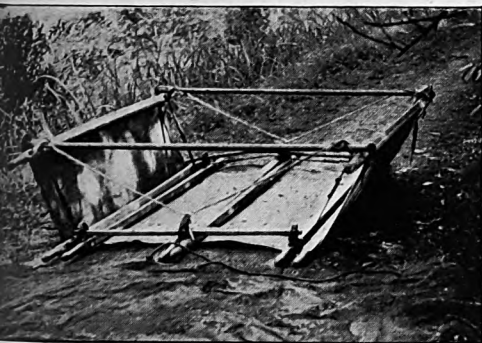


FIG. 3.—The Stretcher Punt.



FIG. 4.—Spare Wheel Raft.



FIG. 5.—Simple Barge.



FIG. 6.—Simple Barge.



FIG. 7.—Lorry Covers—Method of joining.



FIG. 8.—Lorry Covers joined and ready for use.

II.—BARGES.

An extremely buoyant and stable barge can be made by removing and inverting the superstructure and canvas of a 30-cwt. or 3-ton lorry. The method is very simple and readily available, and using variations and modifications of this method it has been found possible to float vehicles up to the weight and size of a 3-ton lorry.

(a) *Simple Barge*.—Place the inverted superstructure in the centre of the canvas. Lash up sides to the uprights, using bolts or sticks through the bolt holes as supports for the ropes. Lash up one end, folding in the surplus canvas. The remaining end is left open as a gangway, being tied up when loading is completed (figs. 5 and 6).

(b) *Twin Barge*.—Similar to above, using two frames end to end. Two canvasses are joined by firm rolled joint (figs. 7 and 8). The roll is included between, and overlaps, the adjacent frame ends. These are joined together by lashings passing over the rolled canvas, making a secure watertight joint. Six lorry tailboards placed lengthways, three each side, form the deck, and with two tailboards as gangway a small car can be run on (figs. 9 and 10). This barge may also be used as a ferry (fig. 11) or for transport of six stretcher cases (fig. 12).

(c) *Transport of Lorry*.—The width of a superstructure is sufficient for the normal lorry wheel base, but to allow for the width of the body the uprights are forcibly splayed outwards for about a foot at the top. Extra length may be obtained by adding a third frame. With firm lashing of joints, extra strengthening by closed stretchers lashed across centre of joints and overlapping tailboards padded with camouflage netting as a runway, it is possible to float a 3-ton lorry. Extra stability may be given by fixing another barge alongside.

(d) *Approximate Capacities of Barges*:—

One 30-cwt. cover (8 feet 8 inches by 6 feet 10 inches), 15 men.

One 3-ton cover (11 feet 3 inches by 6 feet 10 inches), 2-seater car.

Two 3-ton covers (22 feet 6 inches by 6 feet 10 inches), small car and 25 men.

Three 3-ton covers (33 feet 9 inches by 6 feet 10 inches), 3-ton lorry.

(e) *Propulsion* may be by poles, rope or paddles improvised from flattened petrol tins.

(f) *Canvas covers* should be used with care to avoid damage. If intact covers are not available, two worn canvasses superimposed will be an efficient substitute provided holes in the canvasses do not correspond.

III.—FLOATING BRIDGE.

Lorry frames and canvasses, joined as in (b) under "Barges," can be extended to form a floating bridge suitable for traffic up to the size of a small car provided sufficient "decking" is available.



9.—Twin Barge, launched, ready for loading.



FIG. 10.—Twin Barge, with utility van and 8 men.

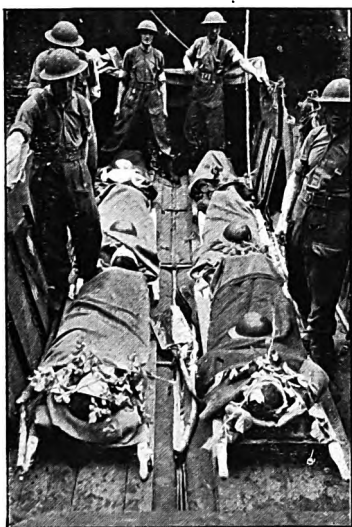


FIG. 12.—Twin Barge, loaded with 6 stretcher cases.



FIG. 11.—Twin Barge with personnel.



FIG. 13.—Floating Bridge.

CONCLUSIONS.

It will be seen from the above notes that it may be possible for a Field Ambulance to negotiate a water obstacle without outside help. The methods are simple and provide for the transport of casualties, equipment, personnel and vehicles. It is also suggested that combatant units might in emergency make use of similar methods for the transport of weapons such as guns and small A.F.Vs., though this has not yet been tried out.

The chief advantage claimed for these methods is that they are easy to apply and only authorized equipment is used throughout.

IMPROVISED RAFT FOR STRETCHER CASES.

AS SUGGESTED BY MAJOR I. B. REES-ROBERTS,

Royal Army Medical Corps.

—— *Field Ambulance.*

THE improvised raft described below is constructed from Field Ambulance equipment and material readily available under active service conditions. It can be assembled in three minutes, is very stable and one or two stretcher cases can be placed on it without removing the patient from the stretcher.

Equipment Required.

Two stretchers.

Eight straps securing.

Two six-foot poles that will fit into the runners of a stretcher.

Sixteen 4-gallon non-returnable petrol tins.

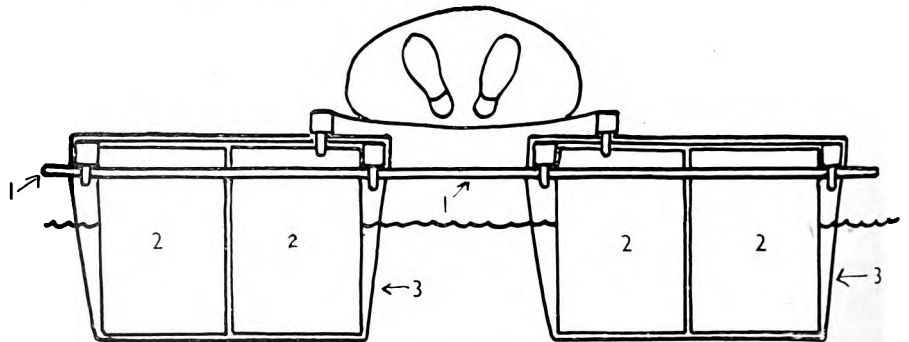


FIG. 1.—End view—Carrying one stretcher.
(1) 6 foot pole. (2) 4-gallon petrol tin. (3) Strap.

The petrol tins do not require sealing if they are emptied by two puncture holes in opposite corners of the lid.

*Assembly of Raft (see diagrams).—*Two petrol tins placed side by side and lid uppermost fit exactly underneath a stretcher between the stretcher poles.

Place four pairs of tins under each stretcher and secure with a strap round the tins and stretcher in each case.

Place the two prepared halves parallel, 18 inches apart, and pass the two 6-foot poles through the runners at each end. Lash the poles to the outside runners and the complete raft is now ready for launching.

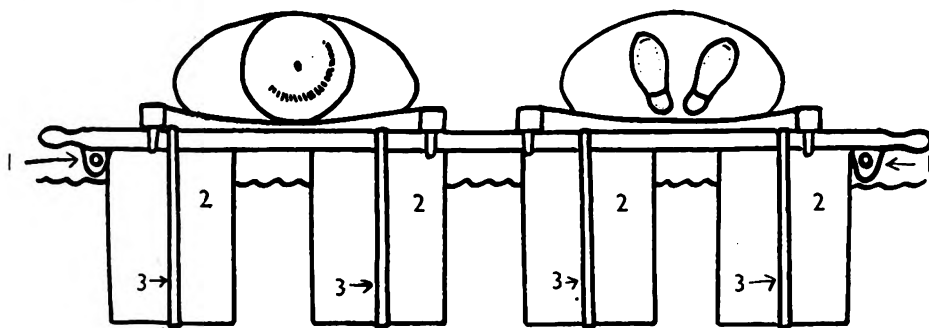


FIG. 2.—Side view—Carrying two stretchers.
(1) 6 foot pole. (2) 4-gallon petrol tin. (3) Strap.

One stretcher case can be placed lengthwise on the raft (*see fig. 1*). If two cases are taken, they are placed across the raft, head to foot, to distribute the weight evenly (*see fig. 2*).

If one end of the raft becomes submerged very little water can enter the tins as the holes in them are covered by the canvas of the stretcher.

VINCENT'S INFECTION OF THE TONSILS.

BY MAJOR A. NIMMO SMITH,

Royal Army Medical Corps,

AND

MAJOR J. P. STEWART, M.D., F.R.C.S. Ed.,

Royal Army Medical Corps.

THIS investigation was undertaken because of the increasing number of cases of Vincent's infection of the tonsils which was seen in the throat department of a General Hospital.

The main object of the investigation was to find any particular method of treatment which would hasten the disappearance of the infection and prevent relapses.

A proportion of the present series of cases had been treated by the usual routine methods, some of them for many weeks, but had failed to respond beyond a certain point. Some of these patients had been discharged from

hospital as cured but, when seen, still showed evidence of an active infection.

All the patients in this series were examined (a) clinically and (b) bacteriologically and a diagnosis of Vincent's infection was made only when the results of the two examinations tallied.

The clinical findings constituted ulceration of one or both tonsils while the bacteriological criterion of infection was the presence of fusiform bacilli and spirilla in numbers much in excess of what may be found in a normal mouth and throat. In the great majority of cases of Vincent's infection of the tonsils these organisms are present in very striking numbers and could not by any possibility be missed, presenting a picture which is typical of this disease. Organisms morphologically indistinguishable from the fusiform bacilli and spirilla met with in the true infection are to be found in the normal mouth and throat but usually only after a long and careful search. Thus in a series of one hundred swabbings of normal mouths and throats 21 per cent showed the presence of fusiform bacilli and spirilla, either separately or in combination, which were not to be distinguished morphologically from those associated with Vincent's infection.

In this connexion it has been said that fusiform bacilli and spirilla are present in over 90 per cent of healthy mouths but after careful investigation our findings cannot substantiate this. It must be emphasized however that swabs in the present series were taken from the buccal surface of the cheeks and from the tonsils, not from the gums between the teeth, where spirilla at least are so often found.

The clinical and bacteriological aspects of this investigation are considered separately.

CLINICAL SECTION.

It is rare for Vincent's infection to attack a healthy tonsil and in the present series each case showed evidence of a chronic tonsillitis. The clinical manifestations are a typical ulceration, greyish in colour, of the tonsil, often a co-existent acute tonsillar infection, and enlargement of the lymph glands in the neck. The breath is very heavy and the tongue coated.

Until recently the routine method of treatment adopted in this hospital was a preliminary intravenous injection of neokharsivan (0.45 gramme) and the local application of one or other of the better known aniline dyes dissolved in spirit. After the ulceration had cleared up the tonsils were removed, mainly because test for cure in this condition is uncertain. The infection may lurk undetected in the deeper tonsillar crypts with consequent immunity from a positive bacteriological finding. Several cases came to this hospital having been treated for this complaint elsewhere and one can recall a case who had been under treatment as an in-patient for six weeks and had been discharged apparently cured but on re-examination was gloriously positive. The danger of such a patient being a carrier will be appreciated. On reviewing the cases treated in this manner one was struck by the comparatively long time taken to achieve cure so search was made for some procedure which

would shorten this period. It was therefore decided to remove the tonsils in the presence of an active ulceration but after the initial medical treatment as already detailed. At first an interval of ten days was allowed to elapse before operation was undertaken but the results were found to be so favourable that the interval was progressively shortened and now surgical removal of the tonsils is performed on the day after admission to hospital.

Operative Technique.—The patient is pre-medicated with scopolamine and omnopon one hour before the operation. He then receives in the theatre 1 gramme of pentothal intravenously and this is followed by the usual intratracheal administration of gas, oxygen and ether. Presumably there might be some contamination of the anæsthetic tube in its passage through the infected area but no untoward incidents have occurred and this risk must be considered negligible. A Boyle-Davis gag is employed with the patient in the recumbent position and the head fully extended. The pharynx is thoroughly painted with 1:1,000 aqueous acriflavine and a pack soaked in this solution is inserted around the anæsthetic tube at the aperture of the larynx. The nasopharynx is packed off in a similar manner. On seizing the tonsil the ulcerated area is avoided if possible as it is extremely friable and, apart from this inconvenience, portions of infected tissue might be disseminated to adjacent areas. The tonsils are dissected with great care in the usual way with scissors. The swabs used for removing the blood from the operation field are wrung out in iced 1:1,000 acriflavine solution and at the conclusion of the operation the tonsillar fossæ are packed with similarly treated swabs. The extreme coldness of these swabs tends to reduce oozing to a minimum. When a dry field has been obtained the tonsillar fossæ are insufflated with sulphanilamide powder. This last procedure serves to keep down any post-operative infection of the raw areas. (Sulphanilamide has no curative effect on the course of Vincent's infection.) After the removal of all packs the patient is returned to bed with an intrapharyngeal airway in position. Rather more bleeding may be met with in this type of case after tonsillectomy but in none of the series did it cause trouble either at the operation or at any time afterwards. The post-operative progress was most satisfactory and healing undelayed. No complication occurred in any of the cases and no recurrence of Vincent's infection took place. The patients were fit for discharge one week after the operation.

Clinical Summary.—(1) A safe method to accelerate the recovery from Vincent's infection of the tonsils has been detailed. This treatment has been carried out in a series of fifty cases.

(2) Chemotherapy consists in the administration of 0.45 gramme neo-kharsivan by the intravenous route and the direct application of 2 per cent brilliant green in spirit.

(3) Tonsil removal is undertaken on the same or following day after the commencement of medical treatment and undelayed healing free from any complication has been obtained in each case.

(4) The soldier is returned more quickly to his unit free of Vincent's infection and much valuable working time is saved.

BACTERIOLOGICAL SECTION.

Swabs from the mouths and throats of one hundred healthy individuals were examined for fusiform bacilli and spirilla. The volunteers were made up of medical officers, nursing sisters, N.C.O.s and other ranks. The swabs were rubbed well over the buccal surfaces of the cheeks and on the tonsils. Two smears were made from each swab, one being stained by carbol fuchsin (1:20 for two to three minutes) and the other by Gram's method.

As stated above 21 per cent showed the presence of organisms indistinguishable in their morphology from the fusiform bacilli and spirilla found in cases of true Vincent's infection. 15 per cent. showed the presence of fusiform bacilli alone, in 5 per cent they occurred along with spirilla, while only one individual showed spirilla alone. The organisms were scanty in 99 per cent of the people examined and only one showed them in larger numbers. They had generally to be carefully searched for before they were observed.

In order to determine the frequency with which Vincent's organisms are to be found in an acutely infected throat, clinically not a Vincent's infection, fifty-three patients were examined, all of them suffering from an acute throat infection, streptococcal in many cases. Twelve (22.6 per cent) showed both fusiform bacilli and spirilla but not in large numbers: fusiform bacilli alone were seen in four (7.5 per cent) instances while only one showed spirilla alone.

The results of the examination of healthy mouths and throats and of the throats of those with acute local infection are set out in tabular form below.

Type of Case	Number	Fusiform bacilli and spirilla	Fusiform bacilli only	Spirilla only
Healthy mouths and throats ..	100	5 per cent	15 per cent	1 per cent
Acute throat infections ..	53	12 (22.6 per cent)	4 (7.5 per cent)	1 (1.8 per cent)

It will be seen that while 21 per cent of healthy mouths and throats harboured fusiform bacilli and spirilla, separately or in combination, these organisms were found in 32 per cent of infected throats and it will be noticed that they were in combination considerably more often in infected throats than in the case of the healthy individual.

There were 53 clinically and bacteriologically proved cases of Vincent's infection of the tonsils, and tonsillectomy was performed on 50 of them. Clinically all healed normally and there was no suggestion of a post-operative Vincent's infection of the tonsillar fossæ. 37 of them were swabbed at intervals after operation and in only one case were fusiform bacilli and spirilla found in large numbers. This patient had not been given neokharsivan before operation. Usually the organisms were either absent or very scanty

in from two to nine days after operation. It was found that the spirilla tended to disappear before the fusiform bacilli.

Bacteriological Summary.—(1) 100 healthy mouths and throats were swabbed. 21 per cent showed the presence of fusiform bacilli and spirilla either separately or in combination.

(2) The organisms were never numerous and were generally found only after prolonged search.

(3) Fusiform bacilli and spirilla were rather more numerous in the throats of patients suffering from acute sore throat (clinically not Vincent's infection) than in the mouths and throats of healthy people, the figures being 32 per cent in infected throats as against 21 per cent in those not infected.

(4) After the removal of tonsils in cases of Vincent's infection fusiform bacilli and spirilla either disappeared entirely from the tonsillar fossæ in from two to nine days or were present in very small numbers and there was never any suggestion of an infection of the tonsillar fossæ by these organisms except in one instance where neokharsivan had not been given before operation.

OBSERVATIONS ON THE TECHNIQUE OF THE BLOOD SEDIMENTATION RATE.

By PRIVATE H. DUSCHINSKY.

Royal Army Medical Corps.

THE essentials of the technique of estimation of the blood sedimentation rate, as employed in nearly all the methods described, are (1) the mixing together of 1 volume of citrate solution and 4 volumes of blood and (2) the placing of a portion of this mixture in a vertical tube, where the rate of sedimentation of the red cells is measured.

As a rule, a quantity of the citrate solution is drawn up into a hypodermic syringe, a vein is pierced, and blood equal to four times the amount of citrate is sucked up.

It was noticed that it was frequently impossible to prevent a varying quantity of air from entering the syringe with the blood. This was due to some minute fault in the fitting of the needle or plunger and, more often than not, the resulting mixture was disturbed to an unknown degree from the essential of 1 volume of citrate and 4 volumes of blood, i.e. 20 per cent citrate and 80 per cent blood.

It appeared important therefore to determine whether much disturbance of the mixture introduced an error of clinical significance in the interpretation of the result. For this purpose the following investigation was initiated, leading in the end to a proposed technique, a modification of that of Harvey and Hamilton (1936), which is thought to be accurate, simple and inexpensive in apparatus.

VOLUMETRIC ERROR.

A volumetric error will be caused by the entrance of air into the syringe. Before the withdrawal of the blood, the syringe contains an exact amount of citrate solution, and the subsequent sucking in of air together with the blood usually results—unless one tries to make a guess-work correction for the air by drawing in more blood—in the final mixture containing more than 20 per cent citrate.

Six Westergren tubes were set up for each of a number of patients, the mixture containing varying amounts of citrate solution from 20 per cent (standard technique) to 45 per cent. The results are shown in Table I, and it will be seen that accuracy of dilution is of considerable importance. The greater the proportion of citrate in the mixture, the slower the sedimentation. An error of only 5 per cent in the case of patient 1 reduced the sedimentation in one hour from 14 to 8 mm., and in patient 3 from 69 to 50 mm., i.e. by 43 and 27 per cent respectively. It is easy to conceive therefore that such inaccuracies in the citrate-blood may either lead to difficulties in the diagnosis or to false optimism where a series of rates is being estimated for progress.

TABLE I

Patient (Clinical Diagnosis)	Readings in Millimetres per hour with Citrate					
	20%	25%	30%	35%	40%	45%
1. L. (TB of spine)	14	8	8	4	2.5	2.5
2. E. (Pulmonary TB)	97	96	83	37	—	—
3. L. (Bronchitis)	69	50	43	32	—	—
4. S. (Bronchitis)	5	3.5	3.5	3	3	2.5
5. J. (Bronchitis)	3	3	2.5	2	1.5	—
6. R. (Pott's disease)	2.5	2	2	1.5	1	—

CLEANLINESS OF GLASS-WARE.

All descriptions of the different methods of estimating the blood sedimentation rate insist on absolute cleanliness of glass-ware. It was thought worth while contrasting the effect in this test of what one might call normal cleanliness and chemical cleanliness.

TABLE II

Time of Reading	Tube :	1	2	3	4	5	6
15 minutes		0.5	1	0.5	0.5	0.5	0.5
30 "		0.75	3	2	1.5	1.5	1.5
1 hour		4	13	14	8	7	8
2 hours		17	30	31	23	22	24
4 "		62	50	59	43	42	44

TABLE III

(Same Patient as above.)

Time of reading	Tube :	1	2	3	4	5
15 minutes	1	1	1	1	1
30 "	2.5	2.5	2.5	2.5	2.5
1 hour	10	10	10	10	10
2 hours	22	22	23	23	23
4 "	59	56	55	56	56

(The tubes of Table II were cleaned as follows: Washed in hot water and dried in the hot-air-oven. The tubes of Table III were cleaned as follows: Autoclaved in 6 per cent chromic acid at 20 pounds pressure for twenty minutes, washed in six changes of tap-water and two changes of distilled water, dried in the hot-air-oven.)

The same patient's blood was set up in the six "clean" tubes of Table II and in the six chemically clean tubes of Table III. The absolute necessity for chemical cleanliness is best seen by comparing the varying figures for one and two hours, the normal times of reading, in Table II with those in Table III.

ALTERNATIVE METHODS.

Vaccine lymph capillary tubes.

Harvey and Hamilton (1936) have critically investigated the use of capillary vaccine tubes of approximately 1 mm. internal bore. They use a column of 70 mm. length and conclude that reliable results can be obtained with these tubes.

For the purpose of estimation of the blood sedimentation rate they take up a quantum of citrate with a teated pipette and expel one drop into a watch-glass, rejecting the remaining citrate as completely as possible. From a finger prick they take up a sufficiency of blood in the same pipette as has been used for the citrate, drop slowly four drops of blood from the vertically held pipette into the same watch-glass, and mix blood and citrate. The capillary tubes are filled from the watch-glass by capillary attraction up to a mark 70 mm. from one end of the tube. The blood column is tilted higher up into the tube, both ends are sealed off with plasticine. The tubes are then placed in a vertical position.

The dilution of the mixture in this method differs from the usual one, 4 of blood and 1 of citrate, the volume of a drop of citrate solution being smaller than that of a drop of blood.

When using the capillary tubes in this laboratory however, the results obtained from the same sample of citrated blood showed distinct discrepancies (Table IV showing six examples).

TABLE IV

Readings in Millimetres

Patient (Clinical Diagnosis)	Westergren Tube After 1 hour	Capillary Tubes							
		After 1 hour				After 24 hours			
		1	2	3	4	1	2	3	4
1. C. (investigation) ..	4	2	5.5	6	7.5	26	27	28	29
2. C. (Bronchitis) ..	5	5	4	5	6	32	37	33	30
3. W. (Lymphadenitis) ..	5	5	5	6	9	39	32	37	37
4. H. (Rheumatism) ..	15	12	15	16	18	36	37	45	41
5. C. (Pleural Effusion) ..	17	15	13	11	12	41	38	38	43
6. R. (Pleural Effusion) ..	14	10	9	16	12	40	40	44	43

The capillary tubes were cleaned with the same care as the Westergren tubes. It was noticed that the initial blood column of 70 mm. had either

increased or decreased in length when the blood was allowed to rise in the tubes before sealing them. This was apparently due to differences in the internal bore of the capillary tubes at different levels of the tubes. In order to prove this irregular bulging, a column of mercury was introduced into the tubes. The length of this column was measured when occupying different portions of the tube. It will be seen from Table V, showing five examples, that vaccine capillary tubes show many differences of bore along their length.

TABLE V

Tube	Length of Mercury Column in Millimetres at a Distance of									
	At end A	5	10	15	20	25	30	35	40	45
1	61	62	63	64	65	66.5	68	68	—	—
2	56	57.5	58	59	59	59.5	60	60	60.5	61
3	63.5	65	66	66	66.5	67	67	67	66.5	66
4	59	—	60	61	62	62.5	62	63	63.5	—
5	60	—	61.5	62	62.5	63	63	62.5	62	—

The observation was made that the twenty-four-hour readings of the same sample of citrated blood could be corrected as shown in Table VI. This correction figure, however, only applies to the twenty-four-hour reading. No such figure could be found as regards the one-hour reading.

TABLE VI

(BLOOD FROM PATIENT B., RHEUMATISM)

Tube	1	2	3	4	5	6	7
Reading at 1 hour	3	3	2	3	2	8	6
Reading at 24 hours	32	35	32	34	31	36	35
Length of blood column	68	71	68	70	67	72	70
Correction figure	2	—1	—2	0	3	—2	0
Corrected reading at 24 hours	34	34	34	34	34	34	35

Manometer Tubing.—To avoid the deviations of the internal bore, manometer tubing was used instead of vaccine capillary tubes. The tubes employed had a length of 100 mm., and a uniform internal bore of 1 mm. To pick up blood one end has to be pointed which was done by grinding on carborundum.

Blood can be taken with such a manometer tube from a finger prick. For this purpose the tube is marked at 20 mm. and 100 mm. from the pointed end. Citrate solution is introduced into the tube up to the first mark and blood from finger prick is taken up till the citrate column reaches the second mark. This assures a correct ratio of blood and citrate. The contents of the tube are mixed in a watch-glass. From there the mixture is drawn up to the 70 mm. mark of another tube to which a teat has been adjusted. The end of the tube is covered with finger and the tube is held horizontally while the teat is removed. A rubber band is placed round the tube instead of sealing with plasticine.

The results were satisfactory throughout (Table VII).

TABLE VII

Patient (Clinical Diagnosis)	Westergren Tube After 1 hour	Readings in Millimetres							
		Manometer Tubes							
		After 1 hour				After 24 hours			
		1	2	3	4	1	2	3	4
1. K. (Bronchitis)	2	3	3	4	3.5	32.5	32.5	33	33
2. L. (Lumbago)	5	6	4	6	6	33	33	33	33
3. S. (Rheumatism)	6	6	6	6	6	34	33	34	33
4. H. (Arthritis)	18	16	16	16	16	38	38	38	38
5. C. (Bronchitis)	17	14	15	13	15	37	37	37	37

Manometer tubing of 100 mm. length has the advantage over the Westergren tubes in that the former can be boiled in chromic acid solution in a small receptacle whereas the Westergren tubes need an inconveniently large container for either boiling or autoclaving. Another advantage of the manometer tubing is that it can be centrifuged and the correction value for total blood volume can be estimated.

SUMMARY.

It has been shown that a volumetric error in the ratio of blood and citrate will affect the result of blood sedimentation. It is therefore absolutely essential that the syringe which is used for withdrawing blood from the vein should be such that no air is sucked in when the blood is drawn up.

Glass-ware used for this test must be chemically clean, otherwise irregularities in the result occur and the readings cannot be relied upon.

When using vaccine capillary tubes small discrepancies in the result occur. This is largely due to the fact that in individual tubes the internal bore throughout the entire length is not uniform.

Manometer tubing provides uniformity of the internal bore, is accurate, easily cleaned and cheap.

I am indebted to Lieutenant-Colonel C. J. Harwood Little, *O.B.E.*, Assistant Director of Pathology, for permission to submit this article for publication, and to Major H. C. Brown for suggestions and help.

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Current Literature.

JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION. 1940. Sept. 28.
Vol. 115. No. 13. P. 1121.—**Sensitivity to Liver Preparations.**
[Queries and Minor Notes.]

The patient referred to in this note was a woman aged 38, suffering from anæmia. From time to time during the past eight years she has tried to take preparations of liver, parenterally and otherwise, but was unable to continue after three or four doses owing to the production of allergic symptoms—urticaria, facial flushing and œdema; when given *per os* the liver caused much nausea. Such a condition is, fortunately, rare, but is a serious one in patients suffering from anæmia. The question is what should be done. Desensitization is not likely to be very successful; attempts to control the effect by the use of drugs, ephedrin or barbiturates is not advisable. It may be found that trial of several preparations may result in the discovery of one which is tolerated—a troublesome and perhaps a tedious procedure—failing which there is nothing but to give the liver by mouth and try to overcome the nausea.

H. H. S.

Reprinted from "Tropical Diseases Bulletin," Vol. 38, 1941, No. 6.

Reviews.

GRAY'S ANATOMY. Twenty-eighth Edition. Edited by T. B. Johnston, M.D., and J. Willis, M.D., M.S. London: Longmans, Green and Co. 1942. 1,347 illustrations. Pp. xx + 1558. Price £3.

The improvements and additions in this edition are all the more praiseworthy when the war-time difficulties faced by the editors and publishers are remembered. The names of Professor Francis Davies who has revised and largely rewritten the section on the Digestive System and of Dr. Denny Brown, writing on the functional significance of the cerebellum, are added to the panel of distinguished contributors of the many editions of Gray's. The compromise nomenclature of the B.R. terminology has been adopted but where confusion may be present the B.N.A. terms are retained or a footnote explanation given. For example, no room for doubt can be left that the term first palmar interosseus muscle describes what the B.N.A. regards as the deep head of the flexor pollicis brevis. The more sentimental of us must accept with regret but with no rancour the continued omission of our old favourite names—Poupart does not get a mention! But the terminology

presented is a sound workable one and should be acceptable to the reasonable. The increased and welcome use of colour in many of the illustrations has in no way spoilt the character of the old "Gray's" pictures.

The general tendency of all Anatomy Schools to pay much attention to applied Anatomy is evident in the stress laid upon the synergic and fixative functions of muscles rather than on their academic action and, again, Major T. T. Stamm has been called upon to present the views of the orthopædic surgeon. The extra radiographs printed are further evidence of this tendency—in the next edition it would be an advantage if the accuracy of fig. 1,095 representing the bronchial tree as described by the late H. P. Nelson could be supported by good lipiodol bronchograms representing both the antero-posterior and lateral views. An authoritative and fuller description of the branches of the bronchial tree and of the broncho-pulmonary segments would be welcome for many papers on this subject continue to appear with the result that a confused nomenclature is in danger of being formed.

The fine quality of Gray's has been enhanced in this edition and we must demur with the publisher's note that the "War Gray," like its twenty-seven predecessors, is primarily a textbook for students. It is surely the authoritative British textbook of Anatomy and an indispensable reference volume for all Post-Graduates.

A. L. D'A.

MODERN TREATMENT YEARBOOK, 1942. Edited by Cecil P. G. Wakeley, C.B., D.Sc., F.R.C.S., F.R.S.E., F.A.C.S., F.R.A.C.S. (Hon.). 13 plates, 19 figures. London: Medical Press and Circular. 1942. Pp. xvi + 300. Price 12s. 6d.

This volume is the eighth of its series. It contains forty-five articles on topics of medical and surgical interest, and is divided into two sections—the first of general interest and the second entitled "War Medicine and Surgery." Its purpose is to keep the practitioner informed of the latest methods of diagnosis and treatment in the subjects with which it deals.

As is customary in this type of book, each chapter comprises a separate article, each article is contributed by a different author and the standards of the articles are as varied as the authors are numerous. It would be invidious to separate the wheat from the chaff and we will be content to state that the book obviously must fulfil its purpose of supplying the practitioner with many neat synopses indicating the trend of modern therapeutics in many branches of medicine and surgery. The value of the work would have been greatly increased if the editor had arranged the chapters so that the articles were in relevant sequence and not jumbled together haphazardly apparently as they were culled from the pages of the *Medical Press and Circular*.

R. M. B. MacK.

STANDARD NOMENCLATURE OF DISEASE AND STANDARD NOMENCLATURE OF OPERATIONS. Third Edition. Edited by Edwin P. Jordan, M.D. Chicago: American Medical Association. 1942. Pp. xv + 1022.

The work on this Nomenclature was initiated by invitation of the New York Academy of Medicine on March 22, 1928. The basic plan of the work was adopted on November 24, 1930, at the Second National Conference. The first publication was in 1932. The present edition has been brought out under the ægis of the American Medical Association, with Dr. Haven Emerson as Chairman, and has appointed a committee to carry out the work. This committee has had the benefit of the co-operation of special committees in each of the fields concerned and of Dr. Edwin P. Jordan, M.D., as editor.

Although it is pointed out in the Preface that there is no essential difference between this and previous editions, there are in fact "about thirty-five hundred additions, deletions and corrections" to the original diagnostic entries. The method of classification, which is well adapted to the card index system of hospital entries, "depends on two primary factors; the portion of the body concerned (topographic) and the cause of the disorder (etiologic). These two elements are designated by numerical digits separated from each other by a hyphen. The first three digits in the disease code describe the topographic site, the last three, following the hyphen, describe the etiologic agent."

Topographic Classification.

- 000 — Diseases of the body as a whole.
- 100 — Diseases of the integumentary system.
- 200 — Diseases of the musculoskeletal system.
- 300 — Diseases of the respiratory system.
- 400 — Diseases of the cardiovascular system.
- 500 — Diseases of the hæmic and lymphatic system.
- 600 — Diseases of the digestive system.
- 700 — Diseases of the urogenital system.
- 800 — Diseases of the endocrine system.
- 900 — Diseases of the nervous system.
- x00 — Diseases of the organs of special sense.

These major groups are further divided in order to specify a definite organ or part of an organ. The digestive system, for instance, is designated by 600 —, and if the stomach, the fourth organ listed in the system, is affected the digits will be 640 —.

Etiologic Classification.—Under this heading, thirteen major classifications are included, the hyphen *preceding* the number in this case.

- 000 Diseases due to prenatal influences.
- 100 Diseases due to a lower plant or animal parasite.
- 200 Diseases due to a higher plant or animal parasite.
- 300 Diseases due to intoxication.

- 400 Diseases due to trauma or physical agent.
- 500 Diseases secondary to circulatory disturbance.
- 550 Diseases secondary to disturbance of innervation or of psychic control.
- 600 Diseases due to or consisting of static mechanical abnormality (obstruction, calculus, displacement or gross change of form) due to unknown cause.
- 700 Diseases due to disorder of metabolism, growth or nutrition.
- 800 New growths.
- 900 Diseases due to unknown or uncertain cause with structural reaction alone manifest; hereditary and familial diseases of this nature.
- x00 Diseases due to unknown or uncertain cause with the functional reaction alone manifest; hereditary and familial diseases of this nature.
- y00 Diseases of undetermined cause.

The topographic and etiologic classifications are set out from page 3 to page 94, each system being divided into its constituent parts represented by the intermediate numbers. Thus pneumonic disease of the lungs would be classified as an acute interstitial disease of the respiratory system and the affection of the organ would add the second and third digits in the *topographic* classification while the *etiologic* would be brought in by adding the number of the *Diplococcus pneumoniae* making the entry 368—101. Similarly, a tuberculous lung lesion would be 360—123.

A Nomenclature of Diseases follows which extends from page 97 to page 616. After this there is a Disease Index, then a Table of Eponymic Diseases and finally a Standard Nomenclature of Operations. Under this last heading "those digits appearing before the dash correspond exactly with those used in the Standard Nomenclature of Disease. The operative procedure completes the code and is expressed by the digits following the dash."

The main operative procedures are :—

- 0 Incision.
- 1 Excision.
- 2 Amputation.
- 3 Introduction.
- 4 Endoscopy.
- 5 Repair.
- 6 Destruction.
- 7 Suture.
- 8 Manipulation.

Thus operation on the liver, consisting of incision only, would be 680—00; or with drainage 680—02 (abscess, cyst). Operation on the abdomen consist-

ing of laparotomy would be indicated by this heading 060—01; repair of inguinal hernia would be shown as 0601—50; and so on.

In the British Army we, of course, follow the British "Nomenclature of Diseases" and all our statistical records are based upon this work. But we greet this effort at Classification with an admiration which is well deserved by a bold and thorough setting forth of all the diagnostic subtleties of medical and surgical expression.

ARCHITECTURAL PRINCIPLES IN ARTHRODESIS. By H. A. Brittain, M.A., M.Ch., F.R.C.S. Edinburgh: E. and S. Livingstone. 1942. Pp. xi + 131. Price 21s. net.

At this time, when severe injuries affecting joints are accumulating, it is to be expected that, in the not too distant future, many of these will need some form of fixation; this book comes at an opportune moment.

The title "Architectural Principles" aptly describes its objective, a goal within the sight of the reader by the end of the third chapter.

Engineers pay tribute to the problem of Static Mechanics as demonstrated in early architecture and buildings. The writer has ingeniously based his fundamental principles on examples of these well known to all and to whom the wonders of a flying buttress were always impressive.

In the early chapters one fact stands out clearly emphasized, "A strut in compression is more stable than a similar strut in tension." The writer has used this to achieve greater stability for grafts at the same time simplifying the problem of post-operative fixation in plaster; the principle is evident throughout each type of arthrodesis described. One exception to this policy is however seen in the case of the spine where the reasons for a changed technique are set out. In this a method of cutting chip grafts, twice described on pages 71 and 22, is used which makes one wonder whether the author is not over enthusiastic for this special method.

A pleasing omission is that of unnecessary detailed points of operative technique; these have been left to the personal methods of the surgeon. Laborious reading is avoided leaving a brief but adequate mental picture of separate stages in the operation as also the mechanical and pathological aims in the mind of the writer.

The drawn illustrations are excellent but perhaps the selection of X-rays is most helpful. These are untouched and therefore show a true and accurate view of the stages together with the end result of each operative method.

The reading is easy and pleasant; with the reasonable price for such a well produced book it will be a useful addition to the library of surgeons faced with these problems in the near future.

W. E. A.

Correspondence.

LORD ROBERTS' MEMORIAL WORKSHOPS.

WE have received from the Countess Roberts the letter from Lieutenant-General Sir George MacMunn, *K.C.B., K.C.S.I., D.S.O.*, which we gladly publish below. It is a great privilege to be able to do anything to help the cause of the Lord Roberts' Memorial Workshops for the assistance of Soldiers, Sailors and Airmen "broken in the wars" and we would add that the necessity for help of this kind is now more urgent than ever.

SIR,—There are various voluntary societies which do national work and which, even in these days of intensive war taxation and war loaning, must go on with the help of public support if these essential activities are to be maintained.

Not least among these is LORD ROBERTS' MEMORIAL WORKSHOPS—a branch of the activities of the SOLDIERS', SAILORS' AND AIRMEN'S HELP SOCIETY. It is for this great work that I again venture to appeal to the patriotic and the kindly, and to those to whom Lord Roberts is still a household name.

The Workshops find useful and happy occupation for those "*Broken in the Wars*"—"In Subsidium et levamen . . . belloque fructorum" as the sonorous inscription on the colonnade of the Royal Hospital, Chelsea, runs.

The object of the Workshops is to enable men whose disablement prevents them from competing in the race for subsistence, to take part on equal terms. The public who support them merely supply the missing vitality in terms of support and help market the products of the Workshops, which are now so well known. Thus, the men are able to produce fine work on equal terms with the uninjured.

No form of assistance could contribute better to the happiness and self-respect of the injured who are enabled "to look the world in the face," self-supporting, and not forgotten.

The Society has now three special anxieties; first, the dependence of the severely disabled of earlier wars, which now increases with age; secondly, the need to extend the benefits of the Workshops to the victims of Hitler's war, and now, equally important, the sustenance of necessitous Service women.

I therefore appeal to all old and, I hope, many new subscribers to help, and may I remind those kind people that if they could sign a certificate engaging to subscribe for seven years (the Society will send the form) then—every pound means two pounds to the injured, by reason of rebate of income tax.

Donations and subscriptions should be sent to:

Admiral of the Fleet Sir Rogers Keyes, Bt.,

Hon. Treasurer, LORD ROBERTS' MEMORIAL WORKSHOPS,
122, Brompton Road, Room S,
London, S.W.3.

I am,

Yours truly,

GEORGE MACMUNN,

Lieutenant-General.

122, Brompton Road, London, S.W.3.

September 30, 1942.

Notice.

VITAMIN B₁.

ANEURINE HYDROCHLORIDE B.P.

WE have received from Messrs. Boots Pure Drug Co., Ltd., their booklet, from which the following is taken:—

"Vitamin B₁-Boots" conforms to the specification for aneurine hydrochloride described in the third addendum to the British Pharmacopœia and is identical with and has the same biological activity as the natural vitamin. Vitamin B₁ occurs as colourless, monoclinic plates, odour and taste faint and branlike, melting point 245-253° C. with decomposition. It is stable to heat in acid solutions, readily soluble in water and almost insoluble in alcohol. Neutral and alkaline solutions deteriorate rapidly especially in contact with air.

"Vitamin B₁-Boots" is supplied in tablets containing 1 mg. to 3 mg. and as a sterile solution in ampoules containing 5 mg. and 25 mg. for injection. The dosage of vitamin B₁ is now usually expressed in milligrams of the pure substance and 1 mg. is equivalent to 320 International Units. The optimum daily requirement of an adult is approximately 2 mg. (640 I.U.). Conditions of increased metabolism such as pregnancy or fever increase the vitamin B₁ requirement and, for this reason, the diet of pregnant and lactating women should contain at least 3 mg. of vitamin B₁ daily.

A serious deficiency of vitamin B₁ in the body results in beri-beri, and for this condition vitamin B₁ is specific and relief occurs promptly and dramatically.

In addition to the specific use of vitamin B₁ in the treatment of beri-beri, it has been recommended for a very wide variety of conditions. There is general agreement that it is of especial value in the treatment of alcoholic neuritis, nutritional neuritis, neuritis and cramp of pregnancy, scurvy (with vitamin C) and in many cases of simple achlorhydric anæmia.

Treatment.—The recommended dose for the treatment of minor deficiencies is one tablet of 3 mg., two or three times a day by mouth. For gross deficiencies a much higher dose may be given at the discretion of the physician and in these cases the parenteral route may be preferable.

Authors are alone responsible for the statements
made and the opinions expressed in their papers.

Journal of the Royal Army Medical Corps.

Original Communications.

INCENDIARY, TRACER AND EXPLOSIVE BULLETS.

By MAJOR J. R. CAMERON,

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Edinburgh.*

THE ingenuity of civilized man has been as actively employed in the manufacture of complex small arms projectiles as of larger shells and bombs but while in previous wars the use of incendiary, tracer and explosive bullets fired from rifles and machine guns was only on a very limited and experimental scale, in the present war, as the result of increase in mechanization and aerial conflict, they are employed more extensively. An explosive or shell bullet has been described as a hollow bullet, charged with explosive or incendiary material, to act on a small scale in the same manner as large shells, and it is designed by its composite character, slender casing and explosive charge to break up on impact in the tissues or elsewhere. As surgeons we are not concerned with its effect on petrol tanks, intricate machinery, armour plating or ammunition deposits, but it is necessary to familiarize ourselves with the structure, component parts and effects of such projectiles in order to fully appreciate the nature of the wounds they produce.

HISTORICAL.

In 1822 the first shell bullets were invented by a Captain Norton. They were of two types, one containing fulminating powder and the other gunpowder. The bullets were elongated, rounded at both ends and had lateral

projections to fit the grooves of the rifle. They had a central cavity, one-third of the width of the bullet, extending from the nose almost to the base. As they were designed for use with the old muzzle loaders of their day they required, as can be imagined, considerable care and time to insert them thus reducing their effect. Their tactical value was never determined.

After the introduction of the breech loading rifle in 1858, about 1862 the Metford shell bullet was designed and adopted for the Enfield rifle. It still possessed the blunt nose of its predecessors and contained fulminating powder in a cavity, closed at the apex by a wax plug and at the base by a wooden plug; during the passage of the projectile through the muzzle the basal plug compressed the powder and wax and the subsequent impact of the bullet on even a sheet of paper sufficed to detonate it. The bullet was 1.06 inch in length and 0.55 inch in diameter and weighed 582 grains filled, of which 57 grains was detonating powder. Similar incendiary and explosive bullets, some of which possessed percussion caps, were invented and adopted at that time by the armies of Austria, Bavaria, Prussia, Russia and Switzerland.

In the Great War of 1914-18 the Germans designed an explosive small arms bullet of a much more complex structure. It was not employed to any extent and its disruptive effect on the tissues is not recorded. At the present time the Germans employ a variety of explosive incendiary bullets, incendiary bullets and tracer bullets in addition to solid core machine-gun bullets. These incendiary and tracer bullets tend to fragment readily against obstacles either before reaching the tissues or in the tissues themselves. Some of the bullets contain phosphorus and produce burning of the tissues.

Fig. 1 shows (a) the construction of the ordinary solid core armour-piercing Mauser 7.92 mm. rifle and machine-gun bullet for comparison with (b) an explosive incendiary bullet of the same calibre, containing both incendiary and explosive compound but lacking an armour-piercing nose cap. Fig. 2 shows (c) an incendiary bullet containing phosphorus, also Mauser 7.92 mm.; it possesses a steel armour-piercing nose cap with elongated and narrowing tail; and (d) a tracer bullet with short steel armour-piercing nose cap and a small copper cartridge case, almost identical in size and appearance with that of a 0.22 bullet set at the tail behind the nose cap and containing the tracer compound. All four bullets shown in figs. 1 and 2 have a gilded steel casing and lead lining, the gilding being of a copper-zinc alloy. The explosive incendiaries are copper coloured at the tip, the remainder being oxidized black; the tracers have a black oxidized tip and the remainder is copper coloured; the phosphorus incendiaries and the solid core bullets are copper coloured throughout. The tracers may be recognized in flight by the bright light they emit in the early stages and the incendiaries may ignite on impact with floors, walls and other obstacles. It is usual for these projectiles to be loaded in series and the proportion of different types is a matter of tactics.

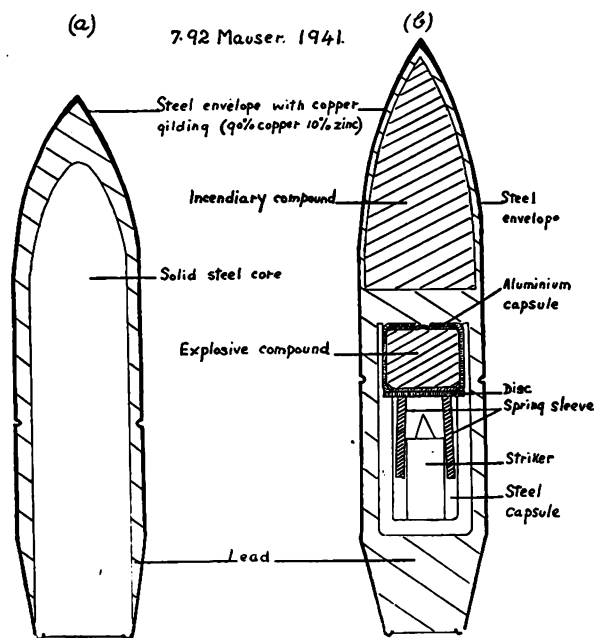


FIG. 1.—(a) German solid core bullet and (b) German explosive incendiary bullet. 7.92 mm. Mauser, 1941. Reproduced by the permission of "Game and Gun."

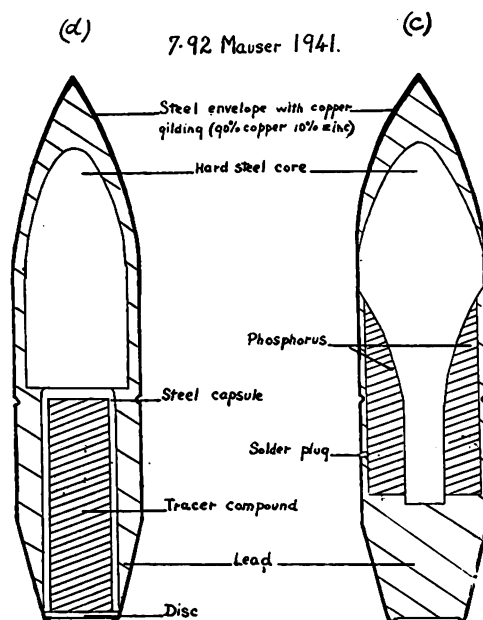


FIG. 2.—(c) German armour-piercing incendiary bullet and (d) armour-piercing tracer bullet. Reproduced by the permission of "Game and Gun."

CASE REPORTS.

Four men were admitted to hospital at 10.30 hours on June 13, 1941, having sustained gunshot wounds, the result of enemy action, less than one hour before. One was injured by a solid core machine-gun bullet, two by portions of tracer bullets and one by an incendiary bullet. They gave the history that an enemy aircraft, presumed to be a Junkers 88, emerged without warning from cloud and machine-gunned their Nissen hutted camp, from a height of just over 100 feet. The flash from the machine gun was described by the men as rather brighter than usual (tracer bullets), and they stated that in some cases the bullets, after penetrating a roof or door, exploded on striking the floor; two of the men thought it was probable that they had been wounded by parts of the same bullet, and this was in keeping with clinical findings, one having been injured by the armour-piercing nose cap of a tracer and the other by a tracer-compound cartridge case. In three cases of wounding by incendiary and tracer bullets the projectiles had perforated the roof of the hut before penetrating the tissues.

Case 1.—Private—aged 24. Serial No. A & D 506. S.M.H.

Injury.—G.S.W. left leg. Compound fracture of tibia and fibula, lower third, with marked comminution of bone and disruption of soft tissues.

Projectile.—Armour-piercing nose cap of phosphorus incendiary bullet.

Examination.—There was a wound of entrance in the calf of the leg posteriorly, approximately 1 inch in diameter, and what appeared to be a wound of exit approximately 2 inches in diameter on the antero-medial aspect of the lower third of the leg. There were the usual signs of a comminuted fracture, though little evidence of shortening. When the primary shell dressing was removed, the lower wound emitted a cloud of grey smoke which had no characteristic odour. The left foot was colder than the right.

Operation.—11.00 hours same day. Anæsthetic N_2O-O_2 -ether. Excision of skin edges, opening of the track of the bullet and irrigation with weak dettol, followed by saline; despite prolonged irrigation the lower wound continued to emit puffs of smoke, in the manner of a cigarette smoker, each time its lips were opened. This continued for almost fifteen minutes. The bullet was not located; moreover the resemblance of the lower wound to a typical exit wound suggested a perforating wound without retained missile. Sulphonamide powder and a vaseline gauze dressing were applied, the alignment of the limb corrected and plaster of Paris applied, with a window for inspection over the lower wound.

Progress.—When examined next day, the wound smoked slightly. Sulphonamide was given orally and antitetanic serum injected. The wound became septic and there was a profuse, offensive discharge. When the patient was able to travel, X-ray examination (fig. 3) showed the retained armour-piercing nose cap of an incendiary bullet.

Plaster was reapplied on five occasions at three-weekly intervals. The discharge decreased and, in five months, the fracture was partly united and the patient walking in plaster. After six months, union was firm, and after seven months the bullet was removed.

Case 2.—Private—aged 24. Serial No. A & D 503. S.M.H.

Injury.—G.S.W. right shoulder.

Projectile.—Armour-piercing nose cap of tracer bullet.

Examination.—There was a penetrating G.S.W. in the right scapular.

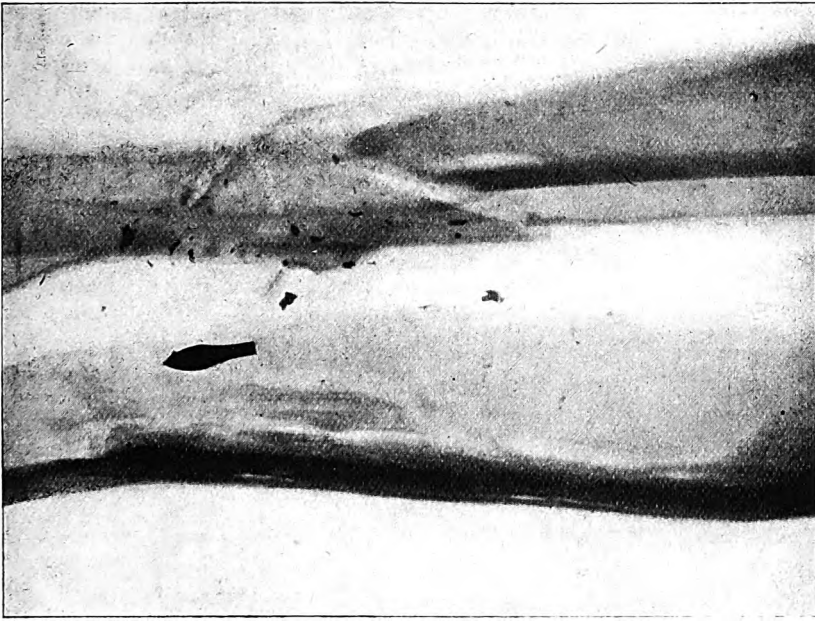


FIG. 3 (*Case 1*).—Radiograph showing comminuted fracture of tibia and fibula, armour-piercing nose cap of phosphorus incendiary bullet, and scattered fragments of lead lining.

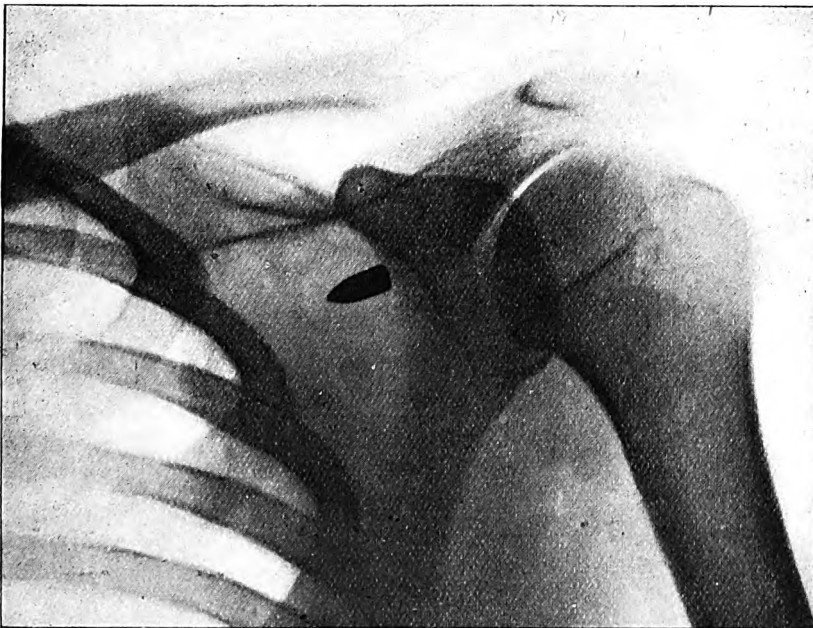


FIG. 4 (*Case 2*).—Radiograph showing armour-piercing nose cap of tracer bullet superficial to the scapula.

region. The track was 6 inches in length, the wound of entrance being small and situated below and medial to the inferior angle of the scapula. There was only a very moderate degree of disruption of muscle.

X-ray examination (fig. 4) showed the nose cap of a tracer bullet in the right scapular region.

Operation.—11.45 hours same day. Anæsthetic N_2O-O_2 -ether. The skin edges were excised and the track partially opened up. It was found to pass superficial to the scapula, notching the medial border and passing upwards and laterally for a distance of 6 inches. A probe was passed up to the nose



FIG. 5 (Case 3).—Radiograph showing compound cartridge container of tracer bullet in gluteal muscles.

cap and the projectile removed through a short incision directly over it. The complete track was irrigated with weak dettol which removed some straw and other debris. Sulphonamide powder was inserted and sutures were introduced but not tied.

Progress.—The wound remained clean. The sutures introduced at operation were tied on the seventh day. The stitches were removed on the

seventeenth day, when the wound was almost completely healed, and the patient returned to full duty on the twentieth day.

Case 3.—Private—aged 24. Serial No. A & D 505. S.M.H.

Injury.—G.S.W. right buttock.

Projectile.—Tracer compound cartridge case.

Examination.—There was a wound of entrance in the right buttock with a track about 5 inches long, extending upwards and outside the pelvis.

X-ray examination (fig. 5) showed the compound cartridge container of the tracer bullet in the gluteal muscles.

Operation.—12.30 hours same day. Anæsthetic N_2O-O_2 -ether. Excision of the wound of entrance and damaged muscle, cleansing of the track with weak dettol and saline. Removal of the projectile, in this case the compound cartridge container of a tracer bullet, and finally application of sulphonamide powder. There was a moderate degree of muscle disruption.

Progress.—No sepsis. Wound sutured secondarily on the eighth day. Stitches removed eighteenth day. Returned to unit on twenty-ninth day, fit for duty.

DISCUSSION.

In such a short series of cases as this it is not possible to express any conclusions on the effects of incendiary and tracer bullets and, when larger series are available, there is rarely time to do more than give urgent attention. From the nature of the projectiles, in these cases, there was a tendency to more severe wounding. The friability of the incendiary and tracer bullets is demonstrated in all cases. A comparison of the projectiles with the X-ray films demonstrated the possibility of radiographic diagnosis of the type of projectile.

The appearance of smoke from a wound suggests the presence of phosphorus in the tissues and the treatment recommended, though not actually employed in Case 1, is to inactivate the phosphorus with 1 per cent or 2 per cent copper sulphate solution, to continue irrigation, and to pick out any accessible fragments. The impression gained from treating Case 1, taking into consideration the early opportunity to deal with it, and the exhibition of sulphonamide powder, was that there ensued a greater degree of sepsis than in ordinary solid-core bullet wounds. This was probably due to the destructive effect of the phosphorus on the tissues. It is possible that the steel sheath of the bullet may have perforated the limb, causing an explosive effect, as there was a wound of exit as well as entrance and only the nose cap was retained.

SUMMARY.

(1) The nature of explosive incendiary, incendiary and tracer bullets is described briefly and their development traced from more primitive projectiles of a similar nature.

(2) Three cases of wounds caused by incendiary or tracer bullets are described.

(3) The projectiles are illustrated by drawings and X-rays and the injuries and treatment are described.

I wish to thank Brigadier William Anderson, Consulting Surgeon, and Professor J. R. Learmonth, F.R.C.S., for their advice and assistance in publishing this paper.

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SULFAGUANIDINE IN THE TREATMENT OF BACILLARY DYSENTERY.

BY LIEUTENANT-COLONEL ERNEST BULMER, M.D. EDIN., F.R.C.P. LOND.,
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AND

MAJOR W. M. PRIEST, M.D. LOND., M.R.C.P. LOND.,

Royal Army Medical Corps.

DURING 1941 we have treated 2,066 soldiers for acute diarrhoeal diseases in a military hospital in the Middle East and more than one quarter of these were suffering from dysentery. Soon after this hospital opened a small supply of sulfaguanidine was received. At first its use was restricted to patients in danger of dying but latterly rather more generous supplies have arrived and this early indication for its use has been considerably modified. Under the circumstances it has not been possible to have a control series of patients treated by us before the drug was available. Neither did we—after watching the usual dramatic response to its exhibition—consider it justifiable to limit its use to alternate cases.

In spite of the smallness of our series of sulfaguanidine treated cases and of the fact that our experience of dysentery is limited to one season and one region we feel that a critical review of our results is opportune.

CLINICAL MATERIAL.

TABLE I.

(a) <i>Total acute diarrhoeal diseases</i>	...	...	...	...	2,066
Acute infective diarrhoea	...	...	...	...	1,500
Dysentery	...	...	...	...	566
(b) <i>Dysentery.</i>					
(1) Amoebic	...	...	...	...	12
(2) Bacillary—Shiga-Schmitz	...	...	...	...	52
(3) Bacillary—Flexner-Sonne	...	...	...	...	200
(4) Bacillary—pathological exudate	...	...	...	...	302
				Total	566
(c) <i>Deaths from dysentery</i>	...	...	...	...	2
(d) <i>Patients treated with sulfaguanidine</i>	...	...	...	...	76

It is probable that cases of acute infective diarrhoea share with true dysentery a common ætiological factor and are merely less severe manifestations of the same disease. An arbitrary distinction has been made based on the naked eye appearance of the stools. A faecal stool without blood or mucus has been called "acute infective diarrhoea" and laboratory investi-

gations have not been done owing to the difficulty of isolating dysentery bacilli from anything but mucus. The criteria for the diagnosis of dysentery are the accepted ones—macroscopic blood and mucus in the stools with a pathological exudate on microscopy and in about one half the cultivation of a pathogenic organism.

The 1,500 cases of acute infective diarrhoea will not be further considered in this paper which will deal only with the 554 cases of classical bacillary dysentery.

THE ROUTINE TREATMENT OF PATIENTS WITH BACILLARY DYSENTERY.

As the use of sulfaguanidine was restricted to carefully selected cases who comprised about 13 per cent of the whole a brief note of the routine treatment adopted will be given to make comparison with other series possible.

(1) *Nursing*.—Special wards have been set aside for the treatment of acute diarrhoea. Strict rest in bed in the early stages has been insisted upon and in incontinent cases dysentery pads of gamgee tissue have been used.

(2) *Diet*.—Patients receive nothing but water for the first twelve hours. They then have the first dysentery diet of weak tea, biscuits, jellies, chicken soup, bovril, Ovaltine, Horlick's or Benger's foods (made with water and not with milk). After a few days the second special dysentery diet is given which includes eggs, crustless bread, custard or cornflour, tea, Horlick's or Ovaltine and it is divided into the usual meal times with feeds in between. When blood and mucus have disappeared from the stools a non-residue light varied diet is given but if this change is made too early relapse occurs. Finally the patients are put on an ordinary diet for a few days before being discharged.

(3) *Drugs*.—Morphine is of great value in the early stages in relieving pain and ensuring much needed rest. Kaolin has some value in the later stages if looseness of the bowels persists. Otherwise drugs have had little part in treatment.

(4) *Saline Treatment*.—After some experience of the orthodox "saline" treatment in the early months we felt unconvinced about its value; the purgation of an already dehydrated patient seemed undesirable and considerable pain was often produced. We hope at a later date to produce evidence of the results in saline and non-saline treated cases but we are satisfied that the withholding of salines has no harmful effect and many of the cases to be considered below have not had this traditional treatment.

(5) *Intravenous Infusions*.—In very ill acute cases blood and plasma transfusions have been given with marked benefit and both measures are of great help in the occasional chronic case who seems likely to die of exhaustion. Intravenous injections of other fluids such as normal saline have not often been used as blood or plasma transfusions seem to be so much more effective.

(6) *Serum*. In four cases of Shiga dysentery Shiga anti-serum has been used; this serum might have been used more often had the bad Shiga cases

reached us in an earlier stage than they did or had they failed to respond to sulfaguanidine.

THE CLINICAL TYPE OF DYSENTERY IN THE MIDDLE EAST.

We feel diffident in trying to appraise the effects of a new drug upon a disease which differs so much in its severity and course in different parts of the world and at different seasons, the more so as our experience of the disease—apart from the mild epidemics of Sonne dysentery seen in England—is less than a year. Dysentery has not appeared in the guise which we had expected as a result of reading of it as it occurred in Salonika, Gallipoli and Mesopotamia in the last war. There have been few grave cases in our series and often complications have been almost absent. On the whole the disease has been mild or moderate in severity but there has been a tendency to chronicity which we have learnt to regard with misgiving as one patient was lost, after an illness of seventeen days, who did not appear to be gravely ill yet took a rapid turn for the worse and died within thirty-six hours of this deterioration.

We cannot produce any figures showing the mortality of a series of 500 cases prior to the introduction of sulfaguanidine in the Middle East and it is unlikely that such a series will be available for control purposes until there is leisure to analyse the Army records after the war.

Our cases of dysentery have been drawn from two sources: either they have been direct admissions from local camps or they have been evacuated from the fighting or desert zone in convoys with other sick or wounded. There is an essential difference between the two groups. Whereas the "convoy" cases may have been suffering from dysentery for one to three weeks according to the military situation, the local cases have as a rule been ill for two to four days only, this being the approximate time elapsing between the onset of symptoms and the reference to hospital of those who did not clear up under treatment by the unit medical officer.

The two groups form a useful comparison. Although it may be true that acute bacillary dysentery is usually a self-limited disease yet cases which come from the desert in a serious state of exhaustion with twenty or more motions daily after perhaps a fortnight's illness give ample evidence of the dangerous subacute and subchronic stages to which the disease may proceed where treatment has of military necessity been delayed, interrupted or inadequate.

Acute cases have usually had a sudden onset with a sharp rise in temperature to 101° or 102° F.; prodromata have included shivering, headache, backache and generalized body pains and have often been pronounced for twenty-four to forty-eight hours before the onset of diarrhoea with consequent difficulties in diagnosis. On admission there may be twenty to thirty stools daily, rapidly becoming small in bulk, inoffensive and consisting only of blood and mucus or the patient may be incontinent with small motions every quarter of an hour. Severe griping lower abdominal pain is almost the rule but tenesmus has been an inconstant feature not often specifically complained

of. There is usually tenderness in both iliac fossæ, more especially the left. The temperature frequently becomes normal in two or three days; we have been impressed with the fact that temperature charts and pulse-rates may be no guide to the severity of the condition and indeed a case may be rapidly progressing downhill when both are normal. It is for this reason that the reproduction of temperature charts is of little value in demonstrating the course of the disease. Even stool charts have fallacies and this will be referred to later.

After two or three days the patient is usually lying inert in bed and showing considerable exhaustion. During hot weather when flies are prevalent he may be too lethargic to brush them off his face. The facies is flushed and we have found a peculiar cyanotic tinge common in severe cases. Dehydration has not been a marked feature except in a few acute cases and in certain prolonged cases such as those evacuated from the battle zone. In these patients exhaustion is a prominent feature and there is a liability to drift into a progressive and dangerous subacute stage. Vomiting has been uncommon but it gave rise to anxiety in two patients as it interfered with the absorption of sulfaguanidine.

The proportion of severe cases has been somewhat larger in the Shiga group but we have not been led to regard this organism as necessarily more dangerous than other members of the dysentery group.

Late complications have been extremely rare and we have had only one case of arthritis and one case of benign hæmorrhagic nephritis unaccompanied by œdema or nitrogen retention who recovered in three days.

THE INDICATIONS FOR SULFAGUANIDINE.

As will be seen in the description of cases below there have been considerable variations in the severity of the cases treated. In the early days the drug was given only when dysentery seemed to threaten life so that the indications were (1) severe diarrhoea; (2) marked toxæmia; (3) a continuance of diarrhoea after ten to fourteen days—it is a routine to sigmoidoscopy all cases showing diarrhoea after this time.

As supplies of the drug increased these strict indications were extended and we have been able to give it to every case where the frequency and nature of the stools, the degree of toxæmia or exhaustion or the severity of the pain have been great enough to suggest that the case would not clear up on routine treatment within a week.

In a few patients there were non-medical indications such as the importance of an early return to duty of a key man or officer, etc.

Were supplies unlimited we should regard the indications for the use of the drug to be any case of bacillary dysentery of sufficient severity to require treatment in bed.

DOSAGE.

Sulfaguanidine is issued with a recommended dosage based on body weight. It has been impracticable to weigh our patients and as we have found the drug to be entirely non-toxic we have adopted a standard dosage

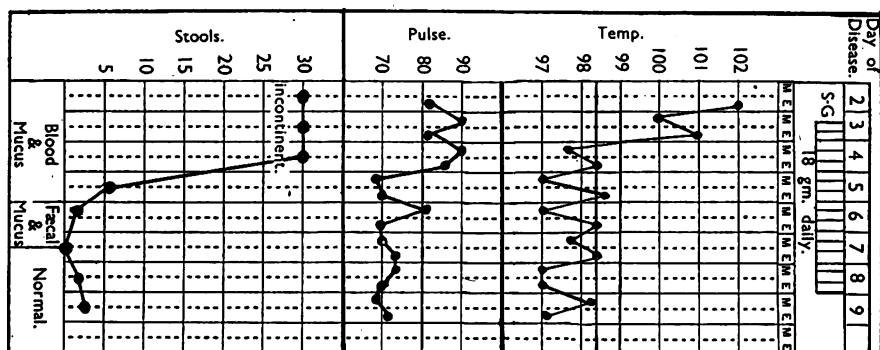
regardless of the patient's weight or build. An initial dose of 6 grammes is given and thereafter the drug is continued in doses of 3 grammes four-hourly until a faecal porridgy stool and general clinical improvement have been maintained for two or three days; 3 grammes thrice daily is given for a further three or more days.

The total quantity given has varied from as little as 18 grammes to as much as 350 grammes; the average effective dose is not less than 50 grammes and is usually between 100 to 200 grammes. In the early days, owing to shortage of the drug much smaller total amounts were given over a shorter period; these patients did not do so well as those to whom the drug was given for longer periods—a week or more. Increasing supplies have made our early stringency in dosage unnecessary.

THE CLASSIFICATION OF THE CASES TREATED WITH SULFAGUANIDINE.

The seventy-six patients treated may be considered under the following heads:—

(1) *Acute Cases*.—Fifty-four have been tabulated in Table II. (2) *Chronic Cases*: fifteen are summarized in Table III. (3) *Deaths*: Particulars of the two fatal cases are given at some length. (4) *Failures*: Three cases are regarded as failures and are detailed below. (5) One case was treated by rectal administration of the drug and a brief note is made of his response.



Acute Flexner. Severity + + +. Toxæmia +. Exhaustion considerable. No treatment other than sulfaguanidine. Dramatic result.

(1) ACUTE CASES (54).

TABLE II.

Day of disease		Number of stools		*Days till stools normal	Amount of SG
No. drug started	Beginning	5th day	10th day		
11	5th	9	1	1.2	87 gm.
20	7th	17	3	1.4	120 gm.
20	8th	22**	4	1.6	134 gm.
3	5th	21**	3	1	120 gm.

*This figure means the first day on which there were not more than two semi-solid stools, faecal and free from blood and mucus—this number must not be exceeded during subsequent days. A strictly formed stool may not be passed for many days after the patient is well and some cases have been discharged *fit* before this has happened.

**Many of these patients were inconsistent and the daily number of their stools has been called 30; it must be realised that in these two groups the figures given for stools is the minimum.

In this table the fifty-four acute cases have been divided into grades of severity and certain details have been averaged for simplicity of presentation. Most of them can be correctly called acute although there was a good deal of variation to their duration as some were local and some were "convoy" admissions with the implications this distinction carries. The table is intended to summarize the essential details of the clinical material rather than to prove statistically any case for sulfaguanidine; the value of the drug can only be assessed by direct clinical observation.

(2) CHRONIC CASES (15).

In these fifteen cases sulfaguanidine was given on account of the long duration of the diarrhoea. The frequency of the stools was much less than in the cases in Table II but an active inflammation of the colon was present in all as seen by sigmoidoscopy and in many of them blood and mucus were visible in the stools on naked eye inspection.

Table III gives a summary of the cases.

No.	Average day of disease drug started	Average number of stools			Average days until stools normal	Average amount of SG
		Beginning	5th day	10th day		
14	23rd	6	4	1.7	9	130 gm.
1	182nd	10	1	1	6	160 gm.

Case 1.—This case was not included in the larger series as the very long duration of the disease makes an average figure misleading. He developed diarrhoea six months before admission; the attack was subacute from the beginning with six stools daily, rarely increasing to twelve and containing mucus with occasional blood. He was treated in another hospital with emetine without improvement, then transferred to a second hospital where he was most thoroughly investigated. Naturally both of these hospitals regarded so chronic a case as probably amœbic if dysenteric at all. He was finally transferred to us and a sigmoidoscopy revealed a reddened mucosa with numerous patches of adherent mucus from which *B. dysenteriae* Shiga was cultivated. He was given sulfaguanidine with a result little short of dramatic as the bowels returned to normal in six days and a sigmoidoscopy showed complete denudation of the mucous membrane.

(3) DEATHS (2).

Case 2.—This young soldier aged 22 had a Flexner dysentery with considerable toxæmia. Although very ill his condition was not regarded as critical but on the fifteenth day of disease he became incontinent of fæces and his condition rapidly deteriorated. He was given sulfaguanidine but he died within twenty-four hours having had only 30 grammes. The autopsy showed a most extensive involvement of the whole of the colon with many areas of complete denudation of the mucous membrane.

At the time he was under treatment we had only sufficient drug to treat

one patient. Had supplies been more plentiful he would have had it at least a week earlier and would probably not have died.

Case 3.—This man contracted severe dysentery with up to forty stools daily at the beginning of the November offensive in the Western Desert. Great difficulties in treatment and evacuation resulted from the military situation and he only came under treatment eight days after the onset. On admission he was incontinent and passing small amounts of blood and mucus with some faecal matter. He was profoundly exhausted and dehydrated, the abdomen was tympanitic and he had severe abdominal pain. *B. dysenteriae* Shiga was cultivated from the stools. He had had serum before admission and we at once put him on sulfaguanidine. A mass developed in the right iliac fossa, pyrexia persisted and there was a leucocytosis of 22,000. Hiccup and vomiting set in and his condition was never good enough for Lieutenant-Colonel A. E. Porritt to attempt an operation for the suspected pericolic abscess. A blood transfusion did not help him and he died sixteen days after admission. At autopsy a pericolic abscess was found and the large bowel was extensively diseased; in addition to large areas of ulcerated mucosa a tubular slough 8 inches long was present in the descending colon adherent in places.

It is unlikely that this man's bowel was in a recoverable condition when he reached us whatever remedies had been available.

(4) FAILURES (3).

We have had three failures in addition to the two fatal cases.

Case 4.—This man had been ill with dysentery for eight weeks and had been treated in an enemy military hospital until re-captured by our troops. On admission he was extremely emaciated, incontinent and passing seven to nine stools daily of a watery consistency and containing neither blood nor mucus. His appetite was poor and the pulse-rate averaged 100 per minute; the general condition suggested malnutrition as well as dysenteric infection. Sigmoidoscopy showed a reddened oedematous mucosa without ulceration and pathogens could not be isolated from the stools or from a rectal swabbing. He received sulfaguanidine in the usual doses but although he slowly improved there is little evidence that he derived any benefit from it.

Case 5.—This man had been desperately ill with dysentery in the battle zone at the beginning of the November offensive and had been gradually moved backwards through field medical units as and when he seemed fit enough. During this time the motions are described as being practically continuous and consisting almost entirely of blood. He was given Shiga anti-serum, intravenous glucose salines, plasma transfusions and from the fifth day of his illness sulfaguanidine. He arrived in our hospital on the sixteenth day of his illness. He was emaciated and exhausted with a remittent fever of 101° to 103° F. and a pulse-rate of 110 to 120 and he was incontinent and passing sloughs of mucous membrane in copious watery and

partly faecal stools. In spite of the grave outlook sulfaguanidine was continued but his condition had changed little after twelve days so it was stopped. Repeated blood and plasma transfusions were given and his condition gradually improved. A further course of the drug was given for seventeen days at the end of which his general condition had still further improved and the number of stools had fallen to six or seven daily. The type of bacillus responsible could not be discovered.

There is little evidence that sulfaguanidine had much influence in this case although the man has survived an attack in which much of his colonic mucosa has been lost, which is surprising, especially when his earlier adventures are taken into account.

Case 6.—A severe case of Sonne dysentery who was given 190 grammes of sulfaguanidine starting on the twelfth day of disease. His condition was little influenced and he drifted into a subacute phase. On the suggestion of Colonel Sidney Smith he was given sulphonamide by rectal instillation and thereafter he made a slow but complete recovery.

(5) SULFAGUANIDINE BY RECTUM.

This has been used in one case in which sigmoidoscopy showed a proctitis which cleared up after 15 grammes had been instilled in suspension into the rectum in divided doses. No conclusions can be drawn from a single case and it was decided not to pursue this line of research.

DISCUSSION.

It must be emphasized that a mere recital of figures as given in the tables is valueless as a statistical method of demonstrating results and these figures have been given with a view to summarizing concisely the type of clinical material and its average behaviour.

We have tried to compare our series with the only other published series we have seen, that of Anderson and Cruickshank (1941)—it will be realized that access to literature is difficult for us. It is not possible to make comparisons between a series of cases in young soldiers and a series of asylum inmates of all ages and in varying degrees of physical fitness. From their clear clinical description it seems that the severity of their cases corresponds to our "one plus" group but they do not deal fully enough with their fatal cases—both treated and untreated—to allow us to pursue the comparison further. The doses we have employed are very much higher than theirs yet we have not met with a single toxic incident.

We regard our general impressions as of much greater value than any figures we can present and we think that the specificity of sulfaguanidine in dysentery is comparable with that of other members of the sulphonamide group in their appropriate indications. If we appeal to our figures we might summarize the position by saying that we lost only two patients (one should have recovered had we had a larger supply of the drug) and that there have

been three failures to respond. Two recovered completely and the third is the only example of post-dysenteric ulcerative colitis we have had. In the other patients the drug acted as we should expect a specific drug to act.

The effects of sulfaguanidine may be judged on two factors, the change in the patient's general condition and the improvement in his stools. These two aspects will be briefly dealt with.

General Conditions.—We have learnt to expect a notable diminution in temperature, pain and toxæmia within twenty-four hours; within forty-eight hours this is frequently dramatic and fully appreciated by the patient. One of us has suffered from an acute Flexner infection and is able to vouch for this effect noticeable after only three doses. One note on a patient says "he was suffering from severe prostration and lying inert in bed too exhausted to drive away the flies which crawled across his face. Forty-eight hours after he was sitting up in bed reading the paper, looking and feeling a different man." Whilst mild attacks may resolve spontaneously in a short time we have seen nothing comparable with this and we have not been led to expect such a change so quickly in saline treated cases.

Stools.—In many cases the effect on the stools has been equally dramatic and a fall in numbers from twenty or even more to four or five in twenty-four hours has been common. Such falls may occur spontaneously or on the cessation of saline administration and we would not stress this aspect so much as the change in the nature of the stools. In most cases they become porridgy and fæcal within forty-eight hours and in many cases within twenty-four hours although small amounts of blood and mucus may persist for some days longer. In a few cases absolute constipation has occurred for as long as four days from the third day of administration onwards. There is usually, however, a dramatic fall to six or seven stools daily within forty-eight hours, reduced to three or four on the fifth day and seldom more than one by the tenth day. The criterion adopted for a "normal" stool in our tables is a high one and if cessation of blood and mucus is used, as in Anderson and Cruickshank's paper, two days must be subtracted from our figures. A vitiating factor in these desert hospitals is the occurrence of diarrhœa of a most elusive though mild nature in all patients—the effect of this on our figures is small but appreciable as dysentery patients are affected in the same way as the others.

We think it important to stress one point when considering Tables II and III; they do not show the behaviour of sixty-nine consecutive cases of dysentery in response to sulfaguanidine. The cases have been selected for treatment out of 554 cases of dysentery and the scarcity of the drug has made this choice so important that a consultation has always taken place before its use has been sanctioned. Our figures, therefore, show the results of the drug upon all our severe cases, all our subacute cases, all our chronic cases, and they have been diluted only very slightly by its use in a few key officers and men.

CONCLUSIONS.

These can be quite brief. A new sulphonamide compound with guanidine has been used in a number of cases of bacillary dysentery and has been found, even in large doses over considerable periods, to be quite devoid of toxic effects; we were dealing with previously fit young soldiers and toxicity might be met with in a less well selected population. If conclusions can be drawn from seventy-six cases, and we feel that they can be, we may repeat what we have already said: sulfaguanidine appears to be as specific against the members of the dysentery group of bacilli as sulfapyridine, for example, is against the pneumococcus. Experience of the various specific remedies during the last twenty years as they have been introduced makes us have considerable conviction in giving this opinion; platitudinous as it may seem we would emphasize the ease with which a specific drug can be recognized after careful use—should there be any doubt that the drug is not specific.

SUMMARY.

(1) During 1941 in a military hospital in the Middle East we have treated 2,066 cases of acute diarrhoeal diseases; 554 were cases of bacillary dysentery.

(2) Seventy-six cases of bacillary dysentery were treated with sulfaguanidine because of (1) the acuteness of the diarrhoea; (2) the severity of the toxæmia; (3) the persistence of diarrhoea; (4) the military importance of an early recovery in a few "key" people.

(3) The drug failed to have any effect on three cases although all recovered.

(4) There were only two deaths.

(5) In the remaining cases the response to the drug was rapid and often dramatic; the results in fifty-four acute and fifteen chronic cases have been tabulated.

(6) The drug has been non-toxic.

(7) We think that sulfaguanidine is specific against dysentery bacilli.

ACKNOWLEDGMENTS.

We would express our acknowledgment of the great help given in this study by those who have successively been medical officers in the dysentery wards, Captains J. H. L. Easton, A. J. Dix Perkin, J. N. U. Russell and A. H. Elliott, and by the Sister in charge of the wards, Miss G. M. Petley.

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CLINICAL OBSERVATIONS ON LOW-BACK PAIN AS A CAUSE OF INCAPACITY AMONG SOLDIERS.

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I HAVE been struck by the number of men referred to my out-patient department because of incapacity produced by pain in the lower back. The characteristics of this pain and complaint have been as follows:

The situation of the pain has been in the region of the 4th and 5th lumbar vertebræ, most often to one or other side, usually unilateral and always associated with pain radiating down the ipsilateral lower limb in the distribution of the sciatic nerve. In a number of cases the pain has radiated down both limbs; in my series this occurred in six instances. In half the number there was a history of injury either recent or having occurred some time previously. In the other half no history of injury was obtainable. In some such cases the pain came on gradually, the patient being often quite unable to state definitely when he first became aware of it. In such instances the patient said he had been aware of a dull ache which had been becoming worse for some weeks or days before he reported sick. In others of this group the pain followed a sudden twist or turn when at work or play or after lifting a heavy weight.

The period selected was from June 1, 1941, until November 30, 1941; this included an average variety of weather and the personnel included men from all branches of the Army. The total number of patients referred to out-patients during this six month period was 520; the total number with the back-ache syndrome was 50, representing 9.8, or practically 10 per cent of all cases referred.

The signs included deformity such as inability to put the heel to the ground, lateral curvature of the lumbar spine, inability to touch the toes or hyperextend the back without aggravating the pain. Laségue's sign (stretching of the hamstring muscles) was present in all. In five cases there was minor wasting of the gluteal fold. The ankle-jerk was absent or markedly diminished in thirty of the cases; there was no alteration of the knee-jerk and there was no alteration in sensation; ten cases showed a raised total cerebrospinal fluid protein; air myelography showed a partial block in five. A sharply defined pressure point of pain was obtainable in forty cases. Local injection of this point with novocain 3 per cent abolished the pain, local and radiating as well, for at least several hours. There were no X-ray changes in the lumbar spinal processes, the intervertebral joints or the sacroiliac joints.

Pain low in the back may be within the distribution of the anterior or posterior primary divisions of the spinal nerve. This paper is concerned with pain arising within structures supplied by the posterior division.

The posterior primary division supplies the following structures: the long muscles of the back (sacrospinalis), all the posterior ligamentous structures, the aponeurosis and periosteal attachments, a portion of the gluteal fascia, the lumbosacral sheath, the supraspinous and infraspinous ligaments, the superficial and the deeper iliosacral ligaments, the sacroischial ligaments and, in part, the iliolumbar ligament, the intervertebral articulations and the sacroiliac articulations (Pitkin [1]).

Irritations are apt to produce either sharply defined localized superficial pressure points of ligamentous and aponeurotic attachments or more diffuse areas of tenderness in muscles and sheaths.

These localized peripheral lesions are capable of producing radiation not only in the posterior but also in the anterior division along many different pathways.

Kellegren [2] showed that pain produced from muscle is always felt diffusely and is referred upon a spinal segmental pattern. Again from the further observations of Kellegren [3] it would appear that beneath the skin there is a second sensitive layer in which pain is localized with fair accuracy. This layer consists of the deep fascia encasing the limbs and trunk and any periosteum, ligament, or sheath situated subcutaneously. On the other hand all the structures deep to this give rise to diffuse pain of more or less segmental distribution. The pain is fully segmental in distribution when arising from the interspinous ligaments, intercostal spaces and other structures situated deeply in the trunk and limb girdles; while pain is more local when arising from the extremities, the joints and the less deeply placed structures in the limbs and trunk.

Pain is usually considered to be of two types, "local" and "referred," the latter having a segmental distribution and a special neurological mechanism. Pain arising from the somatic deep structures, however, presents a gradual transition from pain which is confined to the region of the structure stimulated to diffuse pain of full segmental distribution and, in either case, the situation of the point stimulated may or may not lie within the distribution of the pain. Thus a classification into "local" and "referred" pain cannot be applied consistently. Instead we have to speak of pain which is moderately well localized and diffuse pain which is poorly localized.

The better localized pain is obtained from the more superficial coverings and from the limb joints and other structures of which we are conscious as a result of palpation and movement, while diffuse pain is obtained from the more deeply situated structures of which we are ordinarily unconscious. The deep pain appears to be projected to the regions of those deep structures in which pain is well localized and which are innervated by the same nerve segment as the structure stimulated; in this way the pain is given its segmental distribution. Thus the segmental distribution of diffuse pain may simply be a form of false localization.

Steindler and Luck [4] have drawn attention to the frequency with

which low-back pain and pain in the distribution of the sciatic nerve is associated with local points of tenderness on palpation of the structures supplied by the posterior primary division of the spinal nerve. Moreover, local injection of these "trigger points" with novocain abolished the radiated as well as the local pain at least for some hours. When the requirements of their test were met they considered that the patient reacted positively and that the radiation was a reflex phenomenon elicited by the local lesion.

Steindler and Luck, recognizing the frequency with which low-back ache and pain in the distribution of the sciatic nerve were associated with points of local tenderness to pressure in the same spinal nerve distribution, evolved their percaine hydrochloride test. This test is made by injecting into the area of local tenderness from 5 to 10 c.c. of 1 per cent solution of percaine

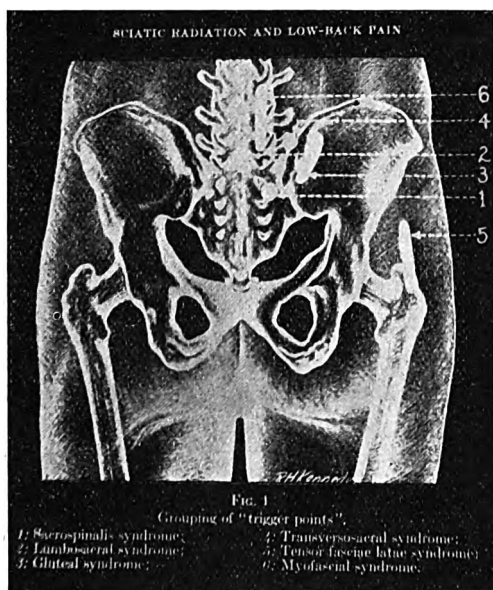


FIG. 1.

hydrochloride. Five postulates must be met to furnish proof that a causal connexion exists between local pain and radiation:

- (1) Contact with the needle must aggravate the local pain.
- (2) Contact with the needle must elicit or aggravate radiation.
- (3) Percaine hydrochloride infiltration must suppress local tenderness.
- (4) Percaine hydrochloride infiltration must suppress radiation.
- (5) The positive leg signs must disappear.

Using this pressure point test it was possible to subdivide sciatic pain into areas thus fixing a definite structure as the site of pain stimulus.

Adopting these conceptions of localization of pain, one can classify low-back pain into two groups of syndromes:—

(A) Pain due to direct pressure on the nerve or its roots.

(B) Pain occurring in the distribution of the posterior primary division of the spinal nerve having a segmental pattern with a special neurological mechanism.

In the latter syndrome it is possible to demonstrate several stereotyped or "trigger" points. By pressure on these points the sciatic radiation is exaggerated. By injection of these points with novocain the pain is relieved, local and diffuse:—

(1) The sacrospinalis syndrome (1 of fig. 1) producing a pressure point at the posterior superior or inferior iliac spine.

(2) The lumbosacral syndrome (2 of fig. 1) with a pressure point at the lumbosacral junction.

(3) The gluteal syndrome (3 of fig. 1) producing a pressure point at the gluteus maximus insertion.

(4) The transversosacral syndrome (4 of fig. 1) with a pressure point at the transversosacral articulation in cases of sacralization of the 5th lumbar vertebra.

(5) The tensor fasciæ latæ syndrome (5 of fig. 1) with the tender point at the lateral border of the fascia and the iliotibial band.

(6) The myofascial syndrome (6 of fig. 1) with vague tenderness along the sacrospinalis muscle and its fascial sheath.

The obstacle in the diagnosis of back pain is the frequent sciatic radiation. Principally the confusion is due to the general assumption that sciatic radiation must necessarily mean direct irritation on either the nerve trunk or its component radicular elements. On the grounds of this assumption, sciatic radiation has been interpreted by various observers as a pressure phenomenon along the entire course of the sciatic nerve. Nevertheless with one or two exceptions there is no proof that pressure is responsible for the phenomenon.

Direct pressure on the sciatic nerve roots obtains when the lesion is within the spinal canal, e.g. tumour, herniated disc, or hypertrophied ligamentum flavum. A high degree of exactness can be obtained for the diagnosis of this type of case. It is based on the high incidence of neurological signs, the primary appearance of sciatic radiation, which is either simultaneous with or antecedent to the low back signs, the high spinal protein and the demonstration of a spinal block.

The possibilities that arthritic proliferations about the intervertebral foramina and in the intervertebral canals may be responsible for direct compression of the sciatic roots cannot be denied, although proof of actual compression of the nerve in the foramen is still lacking. If the compression theory is accepted, it is strange that paræsthesia and signs of spinal irritation are not complained of in the sciatic radiation which follows low-back pain; yet such sensations are noted in the purely arthritic type. They may be referable to the nervus sinus vertebral which was described by Purkinje in 1845 and Von Luschka in 1850, which receives fibres from the sympathetic

ganglion and supplies vessels and periosteum in the intervertebral canal. Still paræsthesia and sensations of heat and cold, so often observed in the arthritic spine, are seldom seen in the sciatic radiation of the low-back pain.

If a true joint is formed between the 5th lumbar transverse process and the sacrum there is the possibility of the development of arthritis in this transversosacral joint.

Group B type of low-back pain was the predominant type in this series: 40 out of 50 cases conformed to this conception. Typical examples were as follows:—

The Sacrospinalis Syndrome.

This was the commonest type, the pressure point was localized well inside the posterior, superior or inferior spine and, within the sacral triangle, the leg signs were positive.

Example 1.—Lance-Corporal A. B., aged 29. The acute onset of low-back pain centred medial to the right posterior superior spine was followed by right sciatic radiation; the leg signs were positive; no scoliosis was present; novocain injection into the "trigger" point abolished radiation for two hours and the leg signs disappeared; cure was effected by three local injections of 5 c.c. of 3 per cent novocain and immobilization for two weeks, followed by massage for one week and return to duty.

The Lumbosacral Syndrome; Pressure Point Lumbosacral Junction.

Example 2.—Second Lieutenant J. M., aged 28. This officer gave a history of pain of insidious onset and of four months' duration; tenderness was present over the left lumbosacral joint, with left sciatic radiation. There was no scoliosis, novocain injection of the left lumbosacral joint gave complete relief for one hour and the leg signs became negative. Conservative treatment by immobilization was tried for four weeks, followed by a period of short wave diathermy and massage; much improvement was obtained and the patient was returned to duty in his general service category after seven weeks' treatment. The condition relapsed again after three months. Further injections of novocain produced relief of temporary type; further immobilization for one month followed by two weeks' short wave diathermy only resulted in moderate cure; spinal myelography showed partial obstruction in the region of the 5th lumbar disc; the spinal fluid protein was 50 mgm. per 100 c.c. It was considered that medical lines of treatment had nothing more to offer this patient; recommendation for operation was not accepted or acted on and lowering of category resulted.

The Supraspinous-Ligament and Intraspinous-Ligament Syndrome.

This syndrome is very similar to the lumbosacral syndrome. The pressure point is localized in the supraspinous ligaments between the 4th and 5th lumbar vertebrae or between the 5th lumbar vertebra and the sacrum and becomes more definite on hyperextension of the back; radiation is not infrequently bilateral and the leg signs are positive. In such cases if immobilization is not sufficient resection of the spinous processes may sometimes become necessary to remove the impingement.

Example 3.—Captain B. W., aged 32. In this case the pain followed a hunting fall sustained some six years previously and was of sudden onset.

It had continued on and off from this time with varying periods of freedom interspersed with recurrence of the pain. While at P.T. one morning he felt an acute pain in the small of the back which radiated down the backs of both thighs, particularly the right. Tenderness was felt maximum over the supraspinous ligament between the 4th and 5th lumbar vertebrae, hyperextension of the back was associated with exaggeration of the pain, the leg signs were positive on the right. Novocain injection gave complete relief of both the local and radiating pain for several hours. The patient was treated by immobilization, repeated local novocain injections followed by a period of short wave diathermy and return to duty free from symptoms after five weeks. This officer is liable at times to get relapses. So far none of these have been so severe as the one described and he has been advised to stop P.T. Excision of the impinging spinous processes might be considered as a permanent cure of this type.

The Gluteal-Myofascial Syndrome.

Tenderness is localized lateral to the inferior and posterior spine, with radiation down the posterior part of the thigh and leg signs are strongly positive. The condition is due to strain or injury along the line of origin of the gluteus maximus.

Example 4.—Corporal W. M., aged 34. The pain was of sudden onset and of four months' duration and tenderness lateral to the posterior spine was observed. The leg signs were positive on the left. There was body shift to the right with left sciatic radiation. Injection of 5 c.c. 3 per cent novocain into the "trigger" point abolished local and radiating pain, the leg signs disappeared, immobilization was maintained for four weeks and a short course of diathermy followed. The patient was returned to duty at the end of six weeks free from symptoms.

Example 5.—Private J. T., aged 41 (Pioneer Corps). The pain was of insidious onset and of ten months' duration. There was tenderness lateral to the right posterior superior spine and at the right mid-gluteal region with sciatic radiation to the right. The leg signs were positive; novocain injection, 5 c.c. 3 per cent. solution, abolished pain local and radiating for twelve hours, the patient was immobilized for four weeks and two further local injections were given. The patient received a course of diathermy and was fit to resume duty at end of seven weeks.

The Tensor Fasciae Lata Syndrome.

The tenderness is over the lateral aspect of the posterior superior spine and extends down the gluteal region over the posterior border of the iliotibial band as far as the trochanter. The strain is in the entire aponeurotic structure which covers the gluteus maximus and blends with the iliotibial band.

Example 6.—Private A. H., aged 19. History of pain of sudden onset: tenderness lateral to the posterior superior iliac spine was noticed on the left with left sciatic radiation. The leg signs were positive; novocain injection lateral to the left posterior superior spine was followed by complete relief of local and radiating pain and the leg signs disappeared. Recurrence responded to injection of novocain into the fascia lata at the level of the great trochanter and rest for two weeks. This soldier was returned to duty at the end of four weeks with no relapse after three months.

The Transverse Sacral Syndrome.

This is produced by arthritis or ligamentous strain. It is seen in sacralization of the transverse process. The tenderness is directly over the transversosacral joint with radiation down the posterior aspect of the thigh; the leg signs are positive. Resection of the articulation may be necessary if immobilization does not give relief.

The treatment adopted for these cases was as follows: rest in bed for periods not less than two weeks. The immobilization consists in raising the lower end of the bed and fixing the leg between the pillows and sandbags or bricks. It is not a practical proposition to fix all such cases either in plaster of Paris or by elaborate mechanical apparatus nor does it appear necessary in the vast majority of cases, sufficient immobilization being obtained by the above procedure. I consider that rest is a most important part of the treatment. The pressure point of tenderness is carefully sought and this is injected with novocain 3 per cent solution. The quantity varying from 3 to 5 c.c. The injection should be done slowly and repeated in a few days if the pain and tenderness are still dominant features.

I have had some very good results from the intravenous injection of the following solution: sodium salicylate, gr. xv combined with sodium iod., gr. xv in 20 c.c. of sterile distilled water. This injection must be given very slowly, considerable reaction resulting if any solution escapes into the tissues. In some cases the relief has been very marked. This injection may be associated or accompanied by a local injection of novocain into a pressure point of tenderness if present. In those cases considered primary neuritis of the sciatic nerve intravenous injection of this solution produces a dramatic disappearance of the pain. The injection may be repeated and in the majority of cases one injection combined with immobilization and rest produces a permanent relief of symptoms. In my series this solution had to be repeated twice in one case and three times in another.

Two or three applications of short-wave diathermy to the structures of the lower back and massage hasten the convalescent period of these cases and introduce a suppleness and flexibility into the joints and soft structure which the period of absolute confinement to bed had helped to produce.

In this series three cases required to have their category in the Army reduced and be recommended for sedentary type of employment. One case of very chronic fibrositis of the sacrospinalis group of muscles after several relapses at this hospital and other places was invalided out of the Service. The rest were fit to return to duty without altering the category. The longest time in hospital was seven weeks, the shortest was two weeks, the average time was twenty-eight days.

The test of recovery was that the patient could be up in the wards all day and do light duties in the hospital and that he could touch his toes and hyperextend the back without producing any stretching discomfort in the distribution of the primary division of the posterior spinal nerve.

OPERATION.

Pennybacker [6], in a series of thirty cases from civilians, found in practice twenty-three lesions of the intervertebral discs, either prolapse of the nucleus pulposus or herniation of the annulus fibrosis. He considers that, while rest and immobilization will cure the majority of cases, operation should be performed in those cases which resist conservative treatment and in those which have relapses.

It was possible in this series to make a diagnosis in five lesions of the intervertebral disc. Case example 2 was of this type. Air myelography showed partial obstruction and a raised C.S.F. protein was considered confirmatory evidence.

So far as Army personnel are concerned, with reference to operative treatment in such cases, it would appear advisable to carefully select the type of case which would be suitable. The points on which decision to operate would require judgment are (a) what is the reaction of the individual to Army life and environment. If he belongs to the class of soldier who is endeavouring to provide a reason for being frequently sick, operation is unlikely to be satisfactory; (b) the time likely to be required before there is a reasonable hope of the soldier being fit to resume duty; (c) what his ultimate degree of fitness is likely to be; (d) conservative methods should be tried first.

SUMMARY.

Fifty cases of low-back pain have been studied among men serving in the Army. The type of lesion found in the large majority of cases is considered to be due to alterations in the structures supplied by the posterior primary division of the spinal nerve. The sciatic distribution of pain is explained as a referred phenomenon and the response to rest and local injection into the pressure point of tenderness is noted.

Of the fifty cases, forty, or 80 per cent, were of this type. All but four were fit to return to duty in periods varying from two to seven weeks, one case required to be invalided and three reduced in category.

The majority of cases occurred in the earlier weeks of training within about eight weeks of being called up. It is considered that the training and rather unusual forms of exercise contributed to this condition. The age period was chiefly the late twenties and early thirties.

My thanks are due to the Commanding Officer of this hospital, Lieutenant-Colonel W. Mackinnon, R.A.M.C., for permission to record these observations on cases treated in this hospital.

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Editorial.

THE COMMON ILLS OF THE SOLDIER.

It was curiosity of the type often known as idle that led us to the opening of a slim volume in the Officers' Mess library at the Depot of a famous infantry regiment. Yellowed pages inside a modern cover were filled with fine copper-plate handwriting, laying down the Standing Orders for His Majesty's —th Regiment of Foot quartered towards the end of the 18th century in what we would now regard as a salubrious overseas station.

In a lengthy introduction the Commanding Officer exhorted his men on the development of soldierly virtues. He finished with a special reference to the greatest danger besetting the soldier, "to wit, drunkenness."

The Orders themselves dealt with many familiar subjects in slow easy-moving sentences which yet had something of the steadiness and rigidity which was shown in another way, we imagine, by the regiment on parade. Instruction was given in the manner of the "Slow March."

It was interesting to learn that the hospital was to be washed down at regular intervals and that it was necessary to refer to the issue of meat.

Appendices included what we would now call Army Forms, dealing with the various regimental reports and returns.

The "Daily State of Sick" did not include as many columns as its modern equivalent but allowed, if anything, a little more space per man, perhaps because in those days legibility was to be encouraged. The specimen form had been partially completed by the writer with entries concerning men of different ranks but suffering from only two diseases—"Fever" and "Flux." We would like to think that he had completed the form on his own initiative and that he was not in any way estimating the diagnostic abilities of the Regimental Surgeon.

Times have changed and neither a Commanding Officer nor (at the other end of the scale) the Medical Inspection Room orderly would now be content with a similar report of sickness and wastage. The medical officer, too, has knowledge and facilities for expressing that knowledge undreamed of by his predecessors; but is "Cold" (or the more elaborate substitute "Coryza") any more satisfactory than "Fever" used to be?

The story of the efforts made to protect the health of the soldier is a long one and advances at times were small. "We sometimes are tempted," writes Sir Harold Scott, "to look with ridicule on the quaint views of years gone by, but let us remember—a sort of *memento mori*—that future generations will ridicule some of our dearest tenets of to-day and that nothing is more easy or more foolish than to censure one age for not possessing the mental equipment of the next."

We may accept without question the value of the work done in environmental hygiene, but there were also those medical officers who studied the diseases afflicting the soldier.

In 1752 Sir John Pringle wrote that "An army cannot be entirely freed from the itch." He also referred to the successful use in the hands of an Army physician of Glauber's salt solution every half hour in cases of dysentery.

Many British medical officers, both naval and military, have done much to found the science of medical statistics and the work of Sir James Ranald Martin in India in 1835 was spoken of in high praise by Dr. Farr of the Registrar-General's Office.

MacGrigor, Halliday, Parkes and Martin, these and other names also come to us from the past with its struggles, failures and successes in improving the lot of the soldier.

The story would not be complete without a reference to Florence Nightingale and we like to remember that she put on record her contradiction of the reputed incorrigibility of the soldier, "I have never been able to join in the popular cry about the recklessness, sensuality and helplessness of the soldier." We do not forget her great influence in improving conditions for the Army in India.

These are but some extracts from Sir Harold Scott's [1] account of the Army in his "History of Tropical Medicine." It forms but a small part of a unique work but we are glad to draw attention to a part as well as to the whole record of a war which has gone on through many conflicts of the nations and which still goes on.

War has changed, soldiers have changed, but we are often told that the principles of war remain the same. "Fever" and "Flux" are still with us and our modern knowledge has given us new weapons with which to attack old enemies whom we now know have vulnerable points. We can unmask many of their attacks, deal with fifth columnists and infiltration tactics, but still we know malaria and dysentery for what they are and may be. With them, too, we find partners, some great, some small but with great nuisance value and often causing personal discomfort and sick wastage not sufficiently appreciated.

Reference to the past at a time when the present and immediate future call for all our energies may seem inopportune but there was one central figure in the past as there is in the present: the British soldier.

We like Guedalla's account of Wellington's remarks on the prospects before Waterloo [2]. "At that moment his eye was caught by a British private in the green alleys of the Park and, as he watched the little scarlet figure staring at the foreign statues under the foreign trees, 'There,' said the Duke, pointing a long forefinger, 'it all depends upon that article whether we do the business or not. Give me enough of it and I am sure.'"

For the Army Medical Services the central figure remains with his common ills, still a challenge to those who contribute to his well-being.

1942. 2 Volumes. Vol. 1, p. 7.

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Clinical and other Notes.

REPORT ON A CASE OF TRAUMATIC DIAPHRAGMATIC HERNIA REPAIR USING THE TRANSPLEURAL APPROACH.

BY CAPTAIN JOHN SWINNEY,

Royal Army Medical Corps.

WOUNDS which are caused by the implements of war tend to differ in their site and severity from those commonly seen in civilian practice. War wounds involving the abdomino-thoracic region are often associated with a high mortality due to the importance of the organs involved and, because of the problems in diagnosis and treatment they present, they are of more than ordinary interest. The late results of such injuries are not often seen and this communication records such a case in the tentative hope that it may be of some value in the consideration of the inevitable future cases.

A soldier, aged 26, was stabbed by a knife in the left side of the chest and left hip on January 17, 1941. He was taken to hospital where examination showed a portion of the great omentum protruding through the chest wound. The following day laparotomy was performed under general anæsthesia, through an upper abdominal mid-line incision and the wound was found to extend from the exterior through the chest wall, pleura and diaphragm into the abdominal cavity. There was no intra-abdominal bleeding or visceral damage and, after excision of the protruding omentum, both abdominal and chest wounds were closed without drainage. The buttock was also sutured.

Though healing throughout was by primary intention the patient did not make the anticipated rapid progress. He developed a cough, and clinical examination showed left basal impaired resonance with diminished breath sounds but, though these findings later became less pronounced, they never entirely disappeared. X-ray examination on February 13, 1941, that is, twenty-seven days after the injury, recorded "the heart seen to be slightly displaced to the right, and the left side of the diaphragm raised."

On February 24 vomiting occurred several times and the patient complained of pain behind the sternum. These symptoms continued for several days and were only partially relieved by the administration of alkalies. A barium meal examination was therefore carried out and the Radiologist reported "left side of the diaphragm raised, no evidence of obstruction in the stomach."

It was shortly after this, on February 25, that the patient first came under my care at No. 16 British General Hospital. He was then complaining of intense "burning" pain behind the sternum, constipation since his operation five weeks before, and dyspnoea on exertion. When examined, his condition was fair only and pallor was noticeable. His temperature was 98·8° F, pulse 96, respiration 20; he had obviously lost weight and admitted this on further interrogation and he was still vomiting small amounts of frothy colourless fluid which last may have accounted, in part at least, for his well-marked exhaustion. There was a soundly healed supra-umbilical mid-line scar and

two healed stab wounds, both one inch long, one in the 7th left intercostal space in the mid-axillary line, the other in the left gluteal region 3 inches below the midpoint of the iliac crest. The only physical signs elicited were: in the abdomen, some tenderness below the left costal margin and, in the chest, impaired resonance with diminished breath and voice sounds at the left base posteriorly extending as high as the inferior angle of the scapula. The apex beat was not apparently displaced. There was, however, a noteworthy feature in the presence of a gurgling sound, audible by auscultation of the area, which showed the other abnormal signs. Furthermore, the minor exertion of being examined caused the patient to become markedly dyspnoëic.

Blood Examination Report.—Blood pressure: Systolic 118; Diastolic 75. Blood examination: Hæmoglobin 96 per cent; R.B.C. 4.25; W.B.C. 8,200. Differential count: Polymorphs 49 per cent; Lymphocytes 43 per cent; Eosinophiles 3 per cent; Monocytes 5 per cent. Blood Group: "A."

Urine Examination.—Specific gravity: 1020; Reaction: alkaline; Albumen: negative. No reduction of Fehling's solution. Microscopic examination of centrifuged deposit: Negative.

From the history, symptoms and physical signs, I made a diagnosis of "left-sided traumatic diaphragmatic hernia." The patient's condition steadily deteriorated. Vomiting increased in frequency until it became almost continuous and rectal saline was instituted to combat the resultant dehydration. The vomit resembled the brown frothy fluid usually associated with acute dilatation of the stomach and went on unabated but after twenty-four hours on intravenous glucose saline recovery was sufficient for a barium meal examination to be performed. The report, dated March 8, confirmed the diagnosis and read as follows: "distortion of the œsophageal entry to the stomach. Supra-fundus loculus supra-diaphragmatic. The loculus fills in the prone position."

The patient was now so ill that extensive surgery was on no account to be considered but, in an attempt to relieve his symptoms, the left phrenic nerve was crushed in the neck under local anæsthesia. The improvement was slight and only continuous intravenous glucose saline combined with half-hourly gastric suction through a Ryle's tube succeeded in making the patient at all comfortable.

By March 11, the man's condition was so desperate as almost to prohibit surgery which offered the only and forlorn hope. After thirty hours' intravenous drip blood transfusion, he was taken to the theatre and anæsthesia was induced by pentothal sodium followed by intratracheal gas and oxygen.

The transpleural approach was chosen using a long incision in the 6th left intercostal space. the chest was opened, the lung allowed to collapse slowly, the 6th and 7th ribs were divided posteriorly, and there resulted an excellent exposure.

On direct inspection, two openings were seen in the diaphragm; a smaller one, the lateral, 1 inch in diameter, in the muscular portion, 2½ inches from the exterior in the mid-axillary line and a larger one in the tendinous portion, 1 inch medial to the first, 1½ inches in diameter. A piece of omentum protruded through the lateral opening and through the medial a loculus of stomach greatly dilated and atonic. Both stomach and omentum were adherent to the edges of the apertures, to each other and to the base of the lung.

The adhesions were divided, those between the loculus of stomach and the diaphragmatic aperture proving the most difficult. The protruded

portion of the omentum and the herniated loculus of stomach were returned to the abdominal cavity through their apertures in the paralysed diaphragm. Then these two apertures were converted into one by division of the intervening strip of muscle, and the actual closing of the new larger opening was effected, after the fashion of Mayo's repair of an umbilical hernia, by overlapping the cut edges. The chest was closed without drainage.

The patient withstood such a major procedure surprisingly well and intravenous drip saline proved beneficial for the next forty hours. The next day, 7 ounces of blood were transfused, but there was a moderate reaction, with rigor, tachycardia, sweating and laboured breathing, so that this treatment was stopped. The salient effect of the operation was dramatic. Vomiting did not occur again and two-hourly feeds of half milk and half water could be increased so rapidly that an almost full diet was ordered within a week.

On March 15, the patient developed a cough with sputum but this was cured completely within ten days. Also, during the early post-operative days, he had attacks at frequent intervals in which the cardinal features were profuse sweating with intense dyspnoea, but inhalation of an oxygen-carbon dioxide mixture gave complete relief. A small effusion developed in the left chest but it was not necessary to aspirate this as complete absorption occurred in ten days.

Beyond these minor episodes recovery was wholly uneventful, the wound healed by primary intention and the patient was allowed out of bed within a fortnight.

X-ray examination on March 28 showed almost complete collapse of the left lung and a course of breathing exercises was ordered. A series of X-rays of the chest, at approximately fortnightly intervals, showed that the lung was expanding and the last examination, on May 4, showed the lung expansion to be complete. The general condition of the patient improved immeasurably and, at the time of writing, he is gaining weight at the rate of 9 pounds a week.

DISCUSSION.

(i) The diagnosis was established with comparative ease from history, symptoms of dyspnoea, dyspepsia and retrosternal pain, together with the physical signs in the chest. The radiological examination merely served to confirm it.

(ii) Immediate cure would, I think, have resulted from suture of the diaphragmatic wounds if undertaken at the first operation but the abdominal approach makes such a procedure difficult. Moreover, if laparotomy is performed as an emergency for injury of the abdominal viscera, a small wound in a moving diaphragm is easy to miss.

(iii) The constant respiratory excursions of the diaphragm militate against spontaneous healing of its wounds and the negative intrathoracic pressure tends to suck the more mobile abdominal organs into the pleural cavity. Such appears to be the mechanism of herniation in this case.

(iv) Two apertures were found in the diaphragm and experience in this and other similar cases suggests that such a number, rather than a solitary opening, is not infrequent. This fact can be explained by the straight line course of weapon or bullet travelling from below upwards, cutting across the concavity of the diaphragm, with or without associated visceral injury in the abdomen.

(v) Constriction of the herniated portion of the stomach, with its consequent subacute dilatation and the fact that, for anatomical reasons, the Ryle's tube could not reach the locus to drain it, resulted in a condition of unrelievable vomiting. This corresponded with the clinical experience and the dramatic response to operation.

(vi) The crushing of the left phrenic nerve in the neck failed as a palliative measure because it was the tendinous part of the diaphragm which constricted the locus of stomach and I suggest that the tendinous part cannot undergo muscular relaxation.

As a means of paralysing the diaphragm for purposes of easing the operative technique, crushing is best done at the time of the major procedure at the point where the nerve crosses the left auricle.

(vii) The post-operative attacks of dyspnoea with sweating seem to defy explanation. The response to oxygen-carbon dioxide mixture was very rapid and relief was always complete within an hour. There was never a concomitant cyanosis so that I postulate a nervous rather than a mechanical cause.

CONCLUSIONS.

(i) Transpleural surgical approach described above for repair of diaphragmatic injury yields an excellent exposure, and the technique of suture is not then difficult.

(ii) When a wound appears to involve the abdomino-thoracic junction, the examination carried out at operation should include careful palpation of the diaphragm; this is because two wounds should be suspected in that organ when the direction of the track of the wound is from below upwards, on account of the anatomical considerations already put forward and corresponding with clinical experience.

I would like to express my gratitude to Colonel D. C. Monroe, Consulting Surgeon to the Middle East Force, for invaluable criticisms and suggestions.

TROPICAL BUBO OR LYMPHOGRANULOMA INGUINALE.

BY LIEUTENANT-COLONEL F. A. R. STAMMERS,

Royal Army Medical Corps,

AND

MAJOR W. A. LAW,

Royal Army Medical Corps.

To the Medical Officer newly arrived in the Tropics the first few cases of lymphogranuloma inguinale are liable to be most puzzling. These few notes are based on an experience of well over one hundred and fifty cases and may be of help to those serving on the West Coast of Africa for the first time.

Much confusion arises from the somewhat loose expression "bubo" which, strictly speaking, is an old-fashioned term for any swelling, usually glandular, whether in groin or elsewhere, whereas "Tropical Bubo" refers to a specific virus infection of venereal origin in which the groin glands become enlarged. It is better therefore to encourage the more general use of the alternative name "lymphogranuloma inguinale." The best description of the disease we have found is the monograph by H. Stannus Stannus, "A Sixth Venereal Disease," 1933, and we have derived much help from it. The following observations, however, are based entirely on our own experiences.

The disease is very common in the African native and is met with frequently amongst native soldiers, carriers and enrolled servants. It also occurs in Europeans, in whom there is a more severe general constitutional disturbance, and usually a more widespread involvement of glands.

Symptoms.—The disease commences within a day or so of intercourse as small painless, often transitory, papules, vesicles, pustules or ulcers on the glands, coronal sulcus or prepuce. They tend to heal quickly so that by the time the glands have appeared, some three to six or even eight weeks later, there is, more often than not, no trace whatever of the primary lesion. In other words the man reports sick because of the gland and not because of the genital lesion.

The first gland affected is at the middle of one or both groins or internal to it. There may be constitutional disturbance such as raised temperature and pulse, headache, malaise and constipation. In the European there may also be rigors, vomiting, cyanosis, slight jaundice, much pain and temperature as high as 103.5° F.

Examination at this early stage shows genitalia either free from any lesion or with small recently healed ulcers and a solitary, freely movable, non-adherent gland which may or may not be tender and spontaneously painful. The painless ones tend to resolve spontaneously, even without rest, and are therefore usually discovered by routine examinations only though others report wishing to know the significance of the gland. If spontaneous resolution does not follow, further changes take place and it is here convenient to suggest a classification covering the full progress of the disease, realizing that the patient may first report sick at any stage.

Classification.—Stage I: A firm solitary gland, adherent to neither skin nor deeper tissues, sometimes tender but often not, sometimes spontaneously painful. Skin not oedematous. No apparent causative lesion other than tiny ulcers or recently healed ulcers on the genitalia.

Stage II: Either firm solitary gland adherent to overlying skin and deeper tissues or with adjacent glands enlarged, often including the external iliac glands palpable as a mass above Poupart's ligament. The affected glands tend to coalesce. There is no more evidence of a primary lesion than in Stage I.

Stage III: The glands in the groin soften and fluctuate. If incised a cavity trabeculated by coarse, fibrous strands and containing yellowish,

sticky, glutinous material is found. If an affected gland is incised a few days before fluctuation has developed, i.e. at transition between II and III, it is found to be packed with tiny discrete abscesses. Again no primary lesion is obvious.

Stage IV: The softened gland-mass ulcerates through the skin and spontaneous fistulation, often multiple, occurs. Secondary infection is almost certain to follow and the sinuses take months to heal.

Diagnosis.—When faced with a native patient complaining of a swelling in one or both groins the usual alternative diagnoses have to be considered and it is not difficult to decide on “glands.” The usual drainage areas must be examined and, where no lesion whatever is to be found and the glands are confined to the groins and fall into the descriptions given in the above classification, it is safe to diagnose lymphogranuloma inguinale, even though there be little or no constitutional disturbance. If there is evidence of small recently healed lesions on the genitalia or even open lesions, if they be tiny ulcers as opposed to the large ones of soft sore, hard chancre and yaws, there again the same diagnosis can be made.

It is, however, possible for a patient to suffer from soft sore, hard chancre or yaws or any combinations of these at the same time as from lymphogranuloma inguinale, and a gland mass in the groin under these circumstances cannot be so certainly diagnosed as the latter disease—it may be due partly to the specific organisms of other diseases and/or partly to secondary infection. The gland “stuffed” with little abscesses, however, is pathognomonic, and the later stage of the trabeculated cavity filled with slimy, sticky material is unlikely to be anything else.

Another difficulty in diagnosis is the frequency of leg-ulcers in native soldiers—the fruits of going unshod—but the affected glands are almost always femoral, not inguinal. In these cases of mixed infection the Frei’s test should be helpful but the only antigen available on the West Coast of Africa at the present moment is the crude form which is not completely reliable.

From time to time, axillary and cervical glands developing into characteristic lymphogranulomatous glands are encountered. They have been described in surgeons who have cut themselves when operating on cases of lymphogranuloma inguinale, and there is little doubt that others result from the same practices as do extra-genital chancres. Another difficulty is when the patient presents himself because of glands in the groin but examination reveals glands elsewhere too—all without any evidence of any source of infection. Here such conditions as tubercle, syphilis, Hodgkin’s disease, etc., have to be considered but there are, without question, other causes in West Africa of a generalized adenopathy as yet unsolved.

Treatment.—As has already been indicated many cases are only discovered at routine medical inspections because the affected glands are painless. Even those causing discomfort should be given a trial of simple

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treatment in their own unit lines. Every effort must be made to prevent spontaneous fistulation since this complication takes many weeks to recover. Even Stage I is treacherous since one can never forecast whether it will resolve or advance to Stages II and III. In a small series (twenty-eight cases) seen during the first three months of this year the average time in hospital was twenty-nine days, the longest being ninety days and the shortest eight days. There is no specific treatment and little guide is given in books of reference. One of us (W. A. L.) has recently applied a line of treatment with most promising results and this will be described in detail at the end of this paper. For the moment the different forms of treatment applied for the various stages of the disease will be related.

Stage I.—Unit medical officers to native regiments report that the majority of cases in the first stage resolve spontaneously; indeed, many never report sick and are only brought to light by routine examinations. Others, however, suffer pain and these should be given two or three days' rest in billets under the observation of their own medical officer as a number subside completely under such treatment. If they do not subside, or if they progress to Stage II, it has hitherto been the custom to send them into hospital. We have been seeking some effective form of treatment which can be given by regimental medical officers no matter what the stage, as this would save much bed space and much time. The sulphonamide group of drugs has proved disappointing. Arsenicals have no effect. One of us (F. A. R. S.) has tried iodides and mercury but these seem, if anything, to hasten progress to Stage III. Application of heat also tends to hasten softening. Surgical excision is certainly effective, the wound healing well and the man being fit for duty in two weeks after the operation, but hospitalization is necessary whereas an efficient chemotherapeutic measure, if available, would be more economical.

Stage II.—This stage, from the Army point of view, is the most difficult to treat as it rarely resolves (but see W. A. L.'s treatment) and it sometimes takes weeks before Stage III—which is easier to treat—is reached. Surgery is disappointing as, in our experience, the wounds tend to break down. An interesting point may here be mentioned. Occasionally, the original gland tends to remain almost discrete, lying somewhat apart from or attached merely by a pedicle to the much larger group of secondarily involved glands, including the external iliac group, and its surgical removal will sometimes lead to rapid subsidence of the main mass. For this reason it has been called "the feeding gland" and we can confirm this observation. Sulphonamides and arsenicals are ineffective and iodides and mercury as also the application of heat tend to hasten progress to Stage III.

Stage III.—Once this stage has been reached spontaneous resolution will not take place but simple interference causes it to settle quite quickly. When first meeting these cases it is very tempting to incise boldly as for any other abscess but the result is disappointing and secondary infection is almost bound to follow, the wound discharging for weeks. The contents

of softened lymphogranulomatous glands are sterile and need as careful guarding against secondary infection as do tuberculous ones. The methods we have employed have been:—

(1) Aspiration at several points and on two or three occasions.

(2) Making a small opening with a tenotomy knife, sweeping the blade round inside to cut the trabeculæ and packing with iodoform gauze or B.I.P.P.

(3) Using a setan—a silk worm stitch does well.

In all methods the skin must be sterilized and dressed with sterile dressings as for a full surgical operation.

Once the contents of the necrotic glands have been evacuated the mass subsides quite quickly and leaves a thickened scar in the groin. There is not much to choose between the above three methods of treatment.

Stage IV.—The difficulty here is the secondary infection and for this reason chemotherapy may offer success but we have had to recommend discharge from the Army in a number of cases that have continued as open wounds in spite of many weeks of varied forms of treatment.

TREATMENT BY ANTIMONY COMPOUNDS (W. A. L.).

The aim of this line of treatment is to find a form of therapy which can be carried out without hospitalization of the patient, thereby saving hospital beds, time and expense in addition to conserving man power within the individual units.

For observation and experimental purpose this treatment was carried out in hospital in a series of nearly one hundred cases. The patients were not confined to bed and were utilized for light fatigue duties during the whole time they were undergoing treatment. This suggests that such a line of therapy could be carried out at regimental medical inspection rooms, camp reception stations or hospital out-patient departments, thereby leaving hospital beds available for casualties and the more seriously sick patients.

The treatment has been mainly carried out on African patients but also in a few European, where the general constitutional disturbance is usually more marked, but this latter fact does not seem to render out-patient treatment impracticable.

The antimony compounds used were lithium antimony tartrate-anthiomaline (May and Baker)—administered intramuscularly and massaged into the buttock—or sodium antimony tartrate given intravenously. The former compound was preferred and the latter used only when anthiomaline was not available. Intramuscular anthiomaline was given two or three times weekly commencing with a dose of 0.5 c.c. and increasing this dose by 0.5 c.c. up to 2.0 c.c. dose for a maximum total of twenty injections. Normally only about ten injections were required indicating the dose of 1 gramme of the compound or the equivalent of 0.1 gramme of antimony metal.

Intravenous sodium antimony tartrate was used as a 1 per cent solution in distilled water, sterilized by boiling, the first injection being 1.5 c.c. and subsequent injections 3.0 c.c. twice weekly. In this series of cases no evil

results or complications of such dosage occurred and all the patients were able to continue their light duties in the hospital.

In the series of cases so treated not one case required surgical interference and several cases, in which fistulæ or ulceration had resulted following either excision or incision and drainage of the glands, healed completely and rapidly with eight to ten injections over a period of three weeks.

In other cases, where primary ulceration had occurred, healing was effected with corresponding ease and rapidity.

In nearly all cases the final result was subsidence of the bubo or swelling with some residual induration, the result of fibrosis on the course of healing in all probability, and the complete loss of pain. To the African soldier the disappearance of pain was tantamount to cure and, as this invariably occurs before the disappearance of the swelling, repeated requests for discharge from hospital were frequently forthcoming from an early stage in the course of treatment.

Where ulceration and fistulæ had occurred, particularly with secondary infection, sulphonamide saline packs were applied locally in addition and, where pain in the swelling was a prominent feature, local heat in the form of fomentations, saline compresses or antiphlogistine were also used but could be discontinued in less than a week as a rule.

The average length of time required to effect resolution in these cases, the majority of which were Stage II or III, was about four weeks during which time the patients were not confined to bed or the ward and were able to continue with light duties. This line of treatment is still being pursued and careful watch being kept for relapses or complications such as fistula formations and ulcerations.

In some cases softening occurs during the course of treatment and aspiration of the yellow fluid is easily carried out and appears to hasten the end-result. Where softening is the result of the type of change resembling caseation seen in Stage III cases, absorption or resolution appears to occur without any local interference, the danger of which is fistula formation.

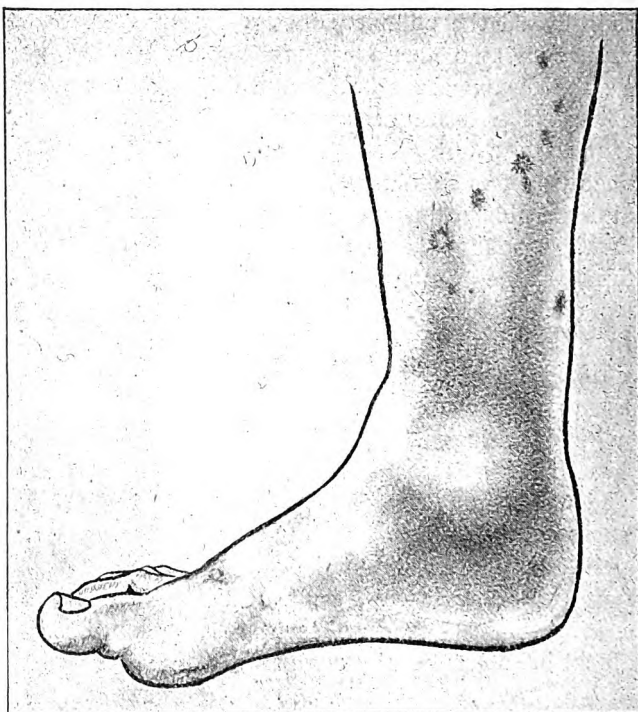
We wish to thank Brigadier R. A. Hepple, *M.C.*, and Colonel K. A. M. Tomory for permission to forward this article for publication.

DECK ANKLES.

BY CAPTAIN W. F. L. FAVA,
Royal Army Medical Corps.

My attention was first drawn in August, 1941, aboard a troopship to the condition which forms the subject of this article about the tenth day on the outward voyage to the East from England. At this time about twenty cases, all with the same complaint, reported sick. During the ensuing few

days about twenty further cases reported. It was then mentioned to me that at about the same stage of the previous trip a similar condition had been noted and had been christened "Deck Foot." Since, however, it is the ankle which is chiefly involved, at any rate in the cases under present consideration, I suggest that "Deck Ankle" is a more appropriate term. The total number reporting sick was forty, which represents about 1.5 per cent of the total strength of the troops aboard, but there is no doubt that had all those been included whose symptoms were so mild that they did not appear on sick parade, the incidence would have been appreciably higher.



Clinical History. The typical history of the condition was as follows:—The patient stated that he had some swelling of one or both ankles with slight aching and stiffness. Discomfort and a feeling of "tiredness" in the feet were complained of, particularly towards the end of the evening and after a tour of "guard" duty. Sometimes the ankles were so swollen that boots could not be worn. The process had arisen rather insidiously and was unrelated to any substantial injury.

Physical Signs.—The ankles appeared swollen on one or both aspects of the joint and, in about half of the cases, the swelling had extended over the front of the ankle and the proximal part of the dorsum of the foot. It was certainly œdematous in nature with marked pitting on pressure. It invari-

ably commenced just above the edge of the uppers of the gym shoes, which had been worn since the time of embarkation, and reached in some cases to as far as 10 cm. above the tips of the malleoli, filling in the hollows on either side of the tendo achillis and obscuring the bony prominences of the malleoli themselves, the astragalus and the tendons on the medial, dorsal and external aspects of the ankle joint. The œdema was first visible as a rule on the medial side of the ankle just below the tip of the internal malleolus but occasionally on the external side.

In the earliest stages no discoloration was evident but by the time the patient reported sick an erythematous blush of the œdematous parts with a fine diffuse ecchymosis into the skin was usually evident, giving a characteristic purplish tinge similar to that of a ripe *Victoria plum*.

Abrasions and ulceration of the skin were absent. Half a dozen or so dusky erythematous macules with the same petechial element about the size of a split pea to a threepenny-bit discreetly sprinkled over the front of the ankle and the lower part of the skin completed the picture in a minority of the cases.

Active movements of the joint were slightly restricted but not painful and passive movements quite free though slightly painful on extreme eversion or inversion of the foot. A certain amount of tenderness on firm pressure over the affected parts was usual but this was never severe. The tissues were mildly inflamed and the skin was somewhat hot to the touch.

Varicose veins were present in six cases and the "Deck Ankle" was always confined to or more marked on that side. Sun erythema in varying degrees was conspicuous over the shins in fifteen and again usually the condition was more marked on the affected side. Flat foot of the first or second degree was noted in six cases. Other deformities of the foot were negligible.

The patients all presented a healthy appearance. Two cases had marked pyorrhœa alveolaris and two enlarged septic tonsils, otherwise all were apparently in perfect normal health. No evidence of cardiac or renal disease could be found and the possibility of dietary deficiency appeared out of the question.

Treatment.—The treatment thought most suitable was rest. This however was generally impracticable through lack of suitable accommodation.

All cases were marked "C" and seen at intervals of four days. Some were told to wear boots and others were left without any treatment beyond exemption from all duties. One case was treated by elastoplast and the wearing of boots. The result of the mere wearing of boots was rapidly successful, the œdema subsiding in the course of a day or two and the discoloration disappearing a few days later. Within five days as a rule appearances were again quite normal.

The following table shows the result of treatment.

Average number of days on treatment after reporting sick:—

- (1) Wearing boots, five days.
- (2) Wearing gym shoes, twelve days.

The largest number of cases reporting appeared on the fourteenth day of the voyage and steadily diminished till the twenty-first day after which no fresh cases reported.

Boots had not been worn at all during the first fortnight but, during the next fortnight, they were worn on one day per week with a view to preventing softness of the skin. From the end of the fourth week, having regard to the same object and in view of the probable cause of "Deck Ankle," orders were given on the S.M.O's. recommendation that boots be worn twice weekly all day except for P.T. and games.

DISCUSSION.

Chronic slight trauma caused by walking on hard decks and repeated slight twisting of the ankles when going up and down hatchways wearing gym shoes in men hitherto unaccustomed to that sort of activity seems undoubtedly the likeliest cause of the condition. The medial and lateral ligaments of the ankle-joint are thus subjected to frequent slight sprains which would account for the ecchymotic element present whilst the lack of support to the soft tissues normally provided by the wearing of boots and possibly some restriction of the circulation due to tightly fitting gym shoes would favour and accentuate lymph stasis.

The presence of a certain amount of inflammation of the tissues previously referred to emphasizes the role of the traumatic factor.

It would seem highly probable that varicose veins and sunburn of the legs if present aggravate the lesion once it has commenced. No doubt both these conditions play a part in hindering the return circulation from the foot.

Flat foot by reducing the natural elasticity of the foot and increasing the element of traumatic "shock" each time weight is put on it is likely to be a predisposing factor.

Although the cases first occurred as the tropical zone was entered and the thermometer registered anything from 85° to 95° F. in the shade there is no reason to think that climatic factors have any direct bearing on this apparently purely local condition.

On the other hand the fact that the vast majority of those affected were wartime recruits and unaccustomed to vigorous training, especially foot drill and route marching, is significant. Under essentially similar conditions when trooping in peace time I have neither seen personally nor heard of any condition resembling "Deck Ankle" among seasoned troops. Moreover the troops at risk with whom this paper is concerned were predominantly R.E. and R.A.S.C. personnel whose lower extremities are less likely to be "toughened" by training than those of the average infantry soldier.

SUMMARY.

(1) A condition for which the term "Deck Ankle" is coined and liable to arise among troops in wartime during the early weeks of a long sea voyage under certain circumstances is described.

(2) It appears to be initiated by slight repeated trauma and to be aggravated by factors favouring lymph stasis such as varicosities and sun erythema and by lack of "seasoning" among troops.

(3) The wearing of gym shoes from morning to night and the absence of support to the soft tissues normally provided by the wearing of boots are the cardinal factors in the ætiology.

(4) The wearing of boots is a specific cure for "Deck Ankle." There is every reason to believe that this measure would be equally useful prophylactically if carried out say twice weekly.

The attention of Medical Officers in charge of troops proceeding abroad might usefully be drawn to the condition and the periodic wearing of boots instigated from the outset.

Incidentally it may be mentioned that the wearing of boots in lieu of gym shoes would reduce considerably the incidence of scalds among mess waiters caused by slipping and spilling hot fluids over themselves. Over twenty-five cases of scalds have been caused thus on this voyage alone.

Finally I should like to thank all those who helped me in these investigations especially the S.M.O., Captain L. Herbert, R.A.M.C., and Major D. Bell, M.D., D.P.H., R.A.M.C., who examined all cases with me and whose assistance made these notes possible.

THE STRETCHER-BEARERS' HIP SLING.

By BRIGADIER E. M. COWELL, C.B., D.S.O.

HAND or shoulder carriage of stretcher cases is notoriously fatiguing to the arm, shoulder and spinal muscles, six men being required to carry a case 1 mile in forty to fifty minutes or more.



By the method here described the weight is carried from the hips alone and two bearers with one relief can give a better performance.

The Hip Sling enables bearers to carry upright, stooping or crawling.

The author with his D.A.D.M.S. recently carried a 159 pounds man 1 mile in twenty-five minutes, including a three minutes' halt.

DIRECTIONS.

Take two stretcher slings, preferably 1939 pattern, open out the adjustable loops and make one continuous sling with the metal pieces in the centre and the fixed loops at either end.

Adjust the length and pass each half twice round the waist making a belt which fits snugly on top of the iliac crests.

Cross the two loop ends and pass each in turn up behind and over the circular turns. The loops should then hang down over the seams of the trousers.

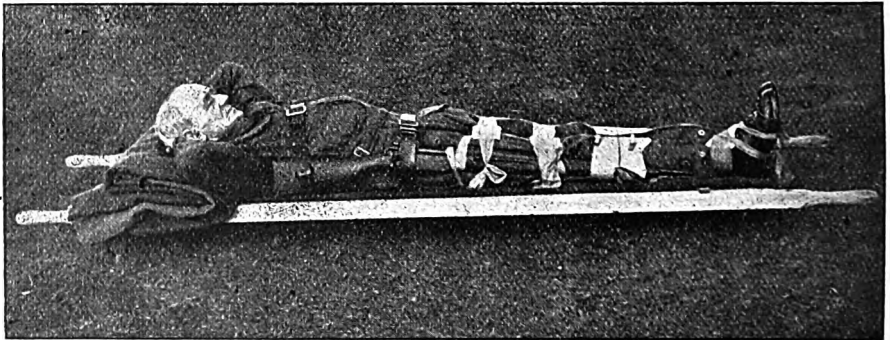
The stretcher is raised and the handles engaged in the loops.

AN EMERGENCY THIGH SPLINT.

BY CAPTAIN P. L. W. WILLIAMS,

Battalion Medical Officer, Home Guard.

THE following note describes an emergency splint for fractured femur (and adjustable for leg bones), made up entirely with personal equipment, which can be applied by two untrained men in the absence of skilled assistance.



DIRECTIONS.

Place the casualty in extended position, limbs together. One man grasps heel and foot of injured limb, makes steady extension and maintains it until bandaging is completed. The other places rifle along outer side, butt well up to arm pit—first removing bolt and ensuring that neither rifle nor magazine contains any cartridges—extracts pull-through, ties bootlaces together and, with large handkerchief or field dressing, puts a figure-of-8 bandage

round rifle, ankle and boot, tying off on sole of boot; then encircles upper part of chest with one belt and hips with another, passing each one, when length permits, round the rifle first. Two field dressings are next applied, pads on wound as far apart as possible, short end of bandage to outer side, long end brought round under thigh, round the rifle, then over and round both thighs, being tied off to the short end, knot on rifle. Finally, pair of anklets buckled together placed round both legs just below knees and then the pull-through cord passed round them and tied to give the anklets a firm grip on the legs.

With acknowledgments to Dr. H. C. Harley who showed in a letter to the *Lancet* that the men's personal equipment could be effectively used for fixation of the rifle.

Current Literature.

J. AMER. M. ASSN. 1941, May 24, v. 116, No. 21, 2405-11. **Diagnosis and Treatment of the Venereal Diseases.**

This is one of a series of letters issued by the Committee on Medical Preparedness of the American Medical Association. It was prepared by the Sub-Committee on Venereal Diseases of the Committee on Chemotherapeutic and other Agents. It deals with gonorrhœa, syphilis, chancroid, L.i. and granuloma venereum, and is a miniature textbook on the subject, presumably for guidance of medical officers of the Services, though it deals with the above diseases in both sexes. As it is, itself, a very condensed summary of a very large subject, only a mere sketch of its contents can be given here, with some comments on points in which the recommended practice differs strongly from the British. In gonorrhœa it gives directions for diagnosis such as are found in good textbooks with due insistence on the necessity of laboratory aids. In treatment of males it advises no local measures except in cases resistant to sulphonamide therapy, and then the local treatment, even irrigation, is to be administered only by skilled technicians; for females no intravaginal treatment is recommended except in complications. Under chemotherapy it is stated that gonorrhœa may be treated on an ambulatory basis. [If this is to be the practice in dealing with the Services, it differs strongly from that in this country where men are kept in hospital until, in gonorrhœa, suitable tests have shown there is good reason for believing that the infection has been eradicated. Here it may be said that the British practice differs from the American recommendations for cases of syphilis in that our Service men are kept in hospital until outward signs have completely disappeared. It may be said for the British practice that it reduces to a minimum the numbers of Service men who are carriers of venereal infection mixing with the civilian population.] The dosage of sulphathiazole, the preferred remedy, or of sulphapyridine, the remedy re-

commended for sulphathiazole-resistant cases, is 3.0 grammes the first day (0.5 every three hours) and 2.0 grammes a day from the second to the ninth. If the discharge is still present on the fifth day, the treatment is to be switched over to sulphapyridine; if it persists on the ninth day, the patient is to be sent to hospital. [The dosage here is much milder but more prolonged than is at present favoured in the British Forces.]

The tests of cure are on usual lines except that instrumentation, sexual excitement and alcohol are barred. Local treatment of sulphonamide-resistant cases is detailed but nothing is said of examination to discover the locality of the focus responsible for holding up the cure. Blood tests to guard against coincidence of occult syphilis are recommended at least three to four months after the onset of the gonorrhœa. For syphilis the alternating continuous plan is recommended, bismuth, subsalicylate, 0.2 gramme per dose, and mapharsen, 30 to 60 mgm. per dose, being the preferred remedies. The arsenical course is eight injections and the bismuth course ten; the two drugs are not to be given simultaneously except for overlap in passing from one remedy to the other at the end of a course. The total duration of the treatment does not seem to be stated, but absolute regularity is insisted upon during the first twelve months.

[Simple calculations will show that the treatment proposed for the U.S. Forces is much less intensive than that for the British, which is based on recommendations of the League of Nations' Committee on the subject. In the British Army the syphilitic patient receives in a year four courses of neoarsphenamine and bismuth, the two remedies being given simultaneously, the number of injections of each being ten, and the total amount per course approximately 5.8 grammes neoarsphenamine and 2.5 grammes bismuth metal, whatever compound of bismuth is chosen. Thus in a year under this scheme the patient receives approximately 23.2 grammes neoarsphenamine and 10.0 grammes bismuth metal. Under the U.S. scheme the patient is presumably to receive in a year thirty injections of bismuth subsalicylate, totalling 3.6 grammes bismuth metal, and twenty-four injections of mapharsen, totalling at most 1.4 grammes. The dosage of mapharsen is based on the assumption that therapeutically it is ten times as potent as neoarsphenamine, so that theoretically the 1.4 grammes just mentioned should correspond to 14 grammes neoarsphenamine. But there is good evidence that its potency is not so great as this. In a symposium on the massive arseno-therapy of early syphilis which has been under trial in New York for some years (reviewed in *Bulletin of Hygiene*, 1940, Vol. 16, 716) it was pointed out by Bruce Webster that the results with 4 grammes neoarsphenamine had been better than those with mapharsen in dosages lower than 1.2 grammes, and this was the total dosage to which mapharsen was stepped up as experience dictated. In an investigation to determine whether experimental yaws of rabbits would respond as well to treatment with neoarsphenamine and with mapharsen as did experimental syphilis, which was reported by Longley, Clausen and Tatum in *J. Pharm. & Exper. Therap.*, 1941, Vol. 71, 49 (*Bulletin of Hygiene*,

1941, Vol. 16), the tables show quite clearly that in yaws and in syphilis 3.5 mgm. mapharsen per kgm. rabbit achieved rather less than did twice this amount of neoarsphenamine.

The inference from these investigations, which were not designed to compare mapharsen with neoarsphenamine but do so more clearly than do any clinical trials in which the issue is obscured by the administration of bismuth, is that 1.4 grammes mapharsen given in accordance with the U.S. Schedule will not achieve as much as would 14 grammes neoarsphenamine.] Careful directions are given for care of syphilis in other than the early stages, for tests of cure and progress, including examination of the C.S.F., for the prevention and treatment of reactions and for the recording of notes on case records. Directions are given on similar lines for the management of the other venereal diseases mentioned above.

J. W. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 10, 1941.

HOPKINS, J. W. **B.C.G. Vaccination in Montreal. Statistical Analysis of the Results of Research by Dr. J. A. Baudouin on B.C.G. Vaccination in Montreal.** *Amer. Rev. Tuberculosis.* 1941, May, v. 43, No. 5, 581-99.

B.C.G. vaccination has had little vogue in Britain. Partly because the incidence of tuberculosis on young children is relatively low (of the 25,176 deaths attributed to all forms of tuberculosis in 1938, 1,377 were at ages under five and of the 21,932 assigned to respiratory tuberculosis only 149), partly because the claims of Calmette and his disciples were extravagant and their statistical data grossly defective. But there was nothing biologically absurd in Calmette's argument, and room for further careful statistical analysis. The present paper is an example of such careful work. The data are not numerous, but cover some thousands of years of life, and are derived from the observation of more than two thousand children. Pains have evidently been taken to secure real comparability of controls and vaccinated children and precision of diagnosis. The result is to make it probable that in respect of both mortality and morbidity, the vaccinated children had a significant advantage over the controls; mortality rates and morbidity rates were uniformly lower; for instance, taking active tuberculosis, the morbidity rate on the controls (ages 0-5) was 120 per 1,000, on the vaccinated 31. Mortality rates were 54 per 1,000 and 19 per 1,000 respectively. Mortality rates for causes other than tuberculosis showed no significant difference between the groups.

M. GREENWOOD.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 10, 1941.

BOYD (Mark F.). **Observations on Naturally and Artificially Induced Quartan Malaria.**—*Amer. Jl. Trop. Med.* 1940. Nov. Vol 20. No 6. pp 749-798. With 5 figs.

This paper contains a very comprehensive analysis of observations made on forty-three patients subjected to malaria therapy with *P. malariae*. Three strains of the parasite were used; they came from widely separated localities

but no observations were made to determine their antigenic relationship. In five patients infection was naturally induced; in forty-three patients trophozoites were inoculated intravenously. In naturally inoculated cases the incubation period varied between four and five weeks; parasites were detected in the blood from three to twelve days before the clinical onset. In artificially induced infections the mean interval between inoculation and the first detection of parasites was 9.5 days, and between inoculation and the clinical onset 19.2 days. The mean duration of naturally induced attacks, regardless of therapeutic interference, was 132 days, and of artificially induced attacks 92 days. Early paroxysms were always simple quartan in type; double quartans and quotidian fevers were only seen in advanced stages of the attack. An onset with remittent fever was rarely seen. Paroxysms after artificial inoculation show greater complexity and irregularity than those following natural infections. The parasite densities observed were considerably lower than those commonly observed in *P. falciparum* and *P. vivax* infections. In one very exceptional case of the series, however, a parasite density as high as 114,000 per c.mm. was observed on one occasion; this patient died, apparently of malaria, in spite of heavy doses of quinine. In the two other cases that terminated fatally malaria does not appear to have been responsible for death.

But little justice can be done to this exhaustive study within the scope of a summary. N. W.

Reprinted from the "Tropical Diseases Bulletin," Vol. 38, No. 7, 1941.

Reviews.

DENTAL SURGERY AND PATHOLOGY, Eighth Edition. By J. F. Colyer and E. Sprawson. London: Longmans, Green and Co. 1942. Pp. xvi + 1067. Price 45s.

So extensive is the field of dental surgery and pathology to-day, so often does it overlap that of general medicine and surgery, so numerous and complex are the operative procedures, that it is increasingly difficult adequately to survey the subject within the confines of one volume. For the dental student this eighth edition of a standard work is a highly satisfactory condensation giving "something on everything," information on up-to-date advances and researches and an authoritative answer to any question likely to be asked in an examination.

The sub-divisions follow the well-conceived plan of the extensively revised previous edition (1938) with further revisions, additions and illustrations. The clarity of exposition, well-spaced paragraphs with bold type

headings, pleasingly clear and large print on excellent paper, make it an easy book to read.

The numerous illustrations—there are 979 figures—are a particularly noteworthy and valuable feature but, selected from many sources, it is inevitable that they are not all of equal clarity. Some twenty are marred by excessively dark shadows while several others are impaired by deficient illumination of the object or lack of contrasting background. Incidentally, the lower molar in figure 7 is now shown inverted.

Suggested improvements to this admittedly good book are (a) *Exclusion* of the exceedingly rare or freakish case. (b) *Inclusion* of photographs showing changes in facial contour and expression following correction of marked anterior malocclusion. (c) *Reduction* in the space given to odontomata—eighty pages is somewhat encyclopædic in such a book—while the pathology is, in parts, possibly too academic for the student. (d) *Deletion* of the first thirty pages (818-849) and their twenty-eight catalogue illustrations of instruments, surely unnecessary in the chapter on “Removal of the Teeth,” for every student is taught by demonstrators the elementary principles of extraction and the appropriate instruments and their uses. (e) *Expansion* into the space so gained of the chapter on “Fractures of the Jaws,” which is too brief, sketchy and insufficiently illustrated.

THE SANITARY INSPECTORS' HANDBOOK. Fifth Edition. By Major Henry H. Clay, F.R.San.I., F.I.S.E. London: H. K. Lewis and Co., Ltd. 1942. Pp. xxii + 534. Price 18s. net.

It is unlikely that any medical officer concerned with the training and employment of Sanitary Assistants is unacquainted with this excellent book, now in its fifth edition in nine years.

The author, in this new edition, has kept before him the requirements of war-time conditions which are likely to remain as factors in public health administration in peace, while at the same time he retains in full those subjects which may be included in the term “normal conditions.”

The Handbook has a particular value for those students whose study for Sanitary Inspectors' qualifications have been interrupted by war service.

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JOURNAL OF THE ROYAL ARMY MEDICAL CORPS

Corps News

DECEMBER, 1942.

EXTRACTS FROM THE "LONDON GAZETTE."

November 10, 1942.—The KING has been graciously pleased to approve the following award in recognition of gallant and distinguished services in the field :—

The Military Medal

6343473 Pte. Frank Kenneth Jacobs, Royal Army Medical Corps.

November 17.—The KING has been graciously pleased to confer "The Efficiency Decoration" upon the following officers of the Territorial Army :—

Royal Army Medical Corps

Colonel P. J. Gaffikin, M.C. (25873).

Lieut.-Colonel W. B. McCall (27089).

Major (temp. Lieut.-Colonel) E. W. Ashworth (33073).

Major C. M. Forbes (37762).

Major R. H. Mortis (47495).

Captain J. W. Levack (16065).

November 24.—The KING has been graciously pleased to approve the following award in recognition of gallant and distinguished services in the field :—

The Military Medal

7345371 Pte. Norman Campbell Nuttall, Royal Army Medical Corps.

November 26.—The KING has been graciously pleased to approve the following award in recognition of gallant and distinguished services in the Middle East :—

The Military Cross

Captain Robert David Irving Beggs, M.B. (108102), Royal Army Medical Corps (Northwood).

The KING has been graciously pleased to approve the following award in recognition of gallant and distinguished services in the field :—

The Military Cross

Captain Richard Pike Lawson, M.B. (115755), Royal Army Medical Corps.

December 3.—The KING has been graciously pleased to approve of the publication of the names of the undermentioned as having been commended for brave conduct :
Lieutenant (temp. Capt.) Knox Isaac

Houston Henry, M.B. (139115), Royal Army Medical Corps.

Miss Phœbe Jane Gibbs (206161), Sister, Queen Alexandra's Imperial Military Nursing Service.

November 10.—The undermentioned Captains (War Subs. Majors), to be Majors :—

R. T. Shipman (53998). October 21, 1942.

C. B. R. Pollock (36405). October 29, 1942.

Major B. Johnson, D.S.O., M.B. (9217), R.A.M.C., ret., is restd. to the rank of Colonel on ceasing to be empld. October 8, 1942.

November 20.—Lieut.-Colonel A. Hendry, M.B. (10763), ret. (R.A.M.C.), at his own request, reverts to the rank of Major whilst so empld. November 1, 1942.

November 27.—Lieut.-Colonel W. E. Adam, M.C., M.D. (3031), retires on ret. pay on account of ill-health. November 27, 1942.

December 8.—Captain A. Cathcart, M.B. (95783), relinquishes his comm. November 18, 1942, and is granted the rank of Major.

The undermentioned Consultants, War Subs. Lieut.-Colonels (temp. Colonels), are granted the local rank of Brigadier :—

G. Massie, M.S., F.R.C.S. (128972). April 11, 1942.

H. L. Marriott, M.D., F.R.C.P. (110700). April 23, 1942.

December 11.—Major T. H. Twigg, M.B. (1143), to be Lieut.-Colonel. October 29, 1942.

Regular Army Reserve of Officers.

Royal Army Medical Corps.

November 20.—Captain H. Mitchell, M.B., M.D. (51061), to be Bt. Major under the provs. of Art. 168, Royal Warrant for Pay and Promotion, 1940. November 14, 1942.

December 8.—The undermentioned Colonels having attained the age limit of liability to recall, cease to belong to the Reserve of Officers :—

Colonel P. J. Hanafin, D.S.O. (9916), late R.A.M.C. September 29, 1942.

Colonel R. P. Lewis, D.S.O. (1468), late R.A.M.C. October 7, 1942.

Colonel R. H. Walsh, D.S.O., O.B.E., M.C. (3214). December 7, 1942.

QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE.

November 24.—Principal Matron Miss G. C. Ball, R.R.C. (206032), retires on ret. pay. November 20, 1942.

Matron Miss C. Pyke, O.B.E., R.R.C. (206373), to be Principal Matron. November 20, 1942.

The undermentioned Sisters to be Matrons :—

Miss M. B. Fullalove (206140). September 22, 1942.

Miss A. E. Read, A.R.R.C. (206401). November 19, 1942.

Miss E. Sanger (206436). November 20, 1942.

The undermentioned Matrons to be supernumerary :—

Miss M. R. MacInnes, R.R.C. (206288). September 22, 1942.

Miss A. Osborne, R.R.C. (206356). November 19, 1942.

November 27.—Sister Mrs. E. M. Kent (*née* Lloyd) (206275), resigns her appt. November 1, 1942.

December 4.—Matron (temp. Principal Matron) Miss G. C. Ball, R.R.C. (206032), to be Principal Matron. September 18, 1941. (Substituted for notifi. in *Gazette* (Supplement) dated June 9, 1942.)

Matron (actg. Principal Matron) Miss M. Loughnan, R.R.C. (206367), to be Principal Matron. May 13, 1942. (Substituted for notifi. in *Gazette* (Supplement) dated September 19, 1941.)

Matron (actg. Principal Matron) Miss R. M. Ruddock, R.R.C. (206402), to be Principal Matron. May 14, 1942. (Substituted for notifi. in *Gazette* (Supplement) dated June 9, 1942.)

PRISONERS OF WAR, MISSING, ETC.

Prisoners of War

T/Major R. Stuppell, Cyrenaica.
Captain J. H. Gibson, Cyrenaica.
Captain J. R. Gibbs, Malaya.
Captain T. C. McInnes, W. Desert.
Captain A. J. N. Warrack, Hong Kong.

Missing

Lieutenant J. A. Carter.
Captain C. A. Cromer.
Captain A. A. N. Bain.
Captain D. W. McCarthy.
Major C. Russell.

ROYAL ARMY MEDICAL CORPS COMFORTS GUILD.

Subscribers to the Royal Army Medical Corps Comforts Guild who have asked that their contributions be given for prisoners of war will be interested to know that the Guild has been approached by the British Red Cross Society to help in specially needful cases with our prisoners "Quarterly Personal Parcels." This the Guild has frequently undertaken to do.

In addition, the Guild contributes various

sums of money to the Red Cross "Prisoners of War General Fund."

The Committee are very grateful to the officers at home and overseas who continue to send donations, and also to the personnel of various units at home who have organised whist drives and dances and sent the proceeds to the Guild.

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APPOINTMENT.

We have been informed that Major B. W. Rycroft, of the R.A.M.C., has been appointed

Surgeon Oculist to H.M. the King of the Hellenes.

DEATHS.

MINCH.—In India on Nov. 8, 1942, Lieut.-Colonel John Berchmans Minch, M.B., R.A.M.C. Born July 29, 1890, he graduated M.B. at the National University of Ireland in 1914 and was commissioned Lieutenant R.A.M.C.S.R. Sept. 15, 1914. Mobilised Sept. 30, 1914, he was promoted Captain April 1, 1915. He took a regular commission November 1, 1919. He was promoted Major Sept. 15, 1926, and Lieut.-Colonel Jan. 8, 1938. During the Great War he served in the operations against the Mohmands and Swats, being

awarded the 1914-15 Star, British War and Victory Medals. He played centre three-quarter on several occasions for Ireland in the years 1913-1914. He was a very fine horseman, a good cricketer and tennis player. An all-round sportsman.

Major-General W. Brooke Purdon, D.S.O., O.B.E., M.C., has sent us the following appreciation of the late Lieut.-Colonel J. B. Minch :—

"The news of the death of Lieut.-Colonel J. B. Minch, R.A.M.C., will sadden the hearts

of his many friends in and out of the Corps, and their deepest sympathy will go out to his wife and son.

"Paddy was one of the real 'characters' of the Corps and the stories of his doings and sayings were many and varied, and the recounting of any of them always seemed to draw out the story of a fresh one. He was a first-class all-round sportsman, having represented Ireland at Rugby football in 1913 and 1914 and at cricket having played for the Gentlemen of Ireland. He was also a member of the Barbarians. Like most Irishmen he was very fond of a horse and did a lot of racing—some of it very successful and most of it amusing—both as an official and an owner in India and Malta. As a rider to hounds he had few superiors, his eye for country, horsemanship and thrust keeping him well to the front. Even in later years, when increasing weight made finding suitable mounts more difficult, he carried on, his beloved brother Matt, an Irish M.F.H., sending over suitable animals from Ireland, which Paddy kept at the head of the hunt. At golf he was an amusing companion for anyone who did not take the game too seriously, and at tennis he and his wife were worthy opponents for most people.

"As a friend Paddy was beyond compare; loyal and affectionate. May his soul rest in peace."

ENSOR.—In Sevenoaks on Nov. 22, 1942, Major-General Howard Ensor, C.B., C.M.G., C.B.E., D.S.O., late R.A.M.C., retired. Born in Cheltenham March 20, 1874, he was educated at Trinity College, Dublin, where he graduated M.B. in 1897. Commissioned Lieutenant R.A.M.C. July 27, 1899, he was promoted Captain July 27, 1902, Major Jan. 28, 1911, Brevet Lieut.-Colonel Feb. 18, 1915, Lieut.-Colonel March 1, 1915, Brevet Colonel June 2, 1915, Colonel May 2, 1925, and Major-General March 26, 1929. He was created C.B. Jan. 1, 1923, and C.B.E. June 3, 1928. Seconded for service with the Egyptian Army from May 2, 1902, till May 1, 1912, he received the 4th Class Osmanieh in 1910 and the 3rd Class Medjidieh in 1912. He was D.D.M.S. North China Jan. 23, 1927, to June 25, 1928. Appointed A.D.M.S. East Anglia Area Sept. 2, 1928, he became D.D.M.S. Eastern Command March 26, 1929. Appointed Honorary Surgeon to the King April 15, 1930, he retired March 26, 1933, and became Colonel Commandant R.A.M.C. Jan. 3, 1937. For a time after retirement he was Superintending Surgeon British India Steam Packet Co. in Calcutta. In West Africa 1897-1898 he saw service on the Niger, Sierra Leone, was employed in the Hinterland and took part in the Lapai Expedition, being awarded the medal with two clasps. In South Africa he took part in the advance on Kimberley, including the action at Magersfontein; operations at Paardeberg Feb. 17 to 26, 1900, and

the actions at Poplar Grove and Dreifontein. Mentioned in despatches he was awarded the D.S.O. and received the Queen's Medal with four Clasps and the King's Medal with two Clasps. He again saw service in the Sudan in 1912 and took part in the operations against the Beir and Anuak Tribes, receiving the Sudan Medal with Clasp. He served in France from Aug. 23, 1914, till Sept. 16, 1919. Six times mentioned in despatches he received the Brevets of Lieut.-Colonel and Colonel, was created C.M.G., and awarded the 1914 Star and Clasp, British War and Victory Medals. A valuable officer, firm, courageous and full of common sense.

SWEETNAM.—On Dec. 6, 1942, Major Stephen Westrope Sweetnam, R.A.M.C., Retired. Born in Greenock Feb. 5, 1880, he was the elder son of Inspector-General of Hospitals S. Sweetnam, R.N. Educated at St. Mary's Hospital, he took the M.R.C.P. and L.R.C.S. in 1893, and joined the Army as Surgeon Lieutenant July 28, 1894. Promoted Surgeon Captain July 28, 1897, and Major R.A.M.C. July 28, 1906, he retired July 28, 1914.

CRAWFORD.—In Ealing on Dec. 9, 1942, Lieut.-Colonel Diron Grey Crawford, M.B., I.M.S., Retired. His claim to remembrance rests on the immense amount of painstaking research he undertook to prepare his "History of the Indian Medical Service, 1600-1913," which he published in 1914. He also brought out the "Roll of the Indian Medical Service," in 1930. The works are packed with information of every kind and widely gathered. In compiling these two works he had picked up a lot of information about the Army Medical Service, which was readily placed at the disposal of Colonel Johnston for his "Roll of the Army Medical Service 1742-1898," and the writer. Colonel Crawford was the son of J. A. Crawford, Bengal Civil Service, and was born in Chinsura July 21, 1857. He entered the I.M.S. as Surgeon October 1, 1881, and retired as Lieut.-Colonel Dec. 5, 1911. He rejoined Nov. 7, 1914, till March 29, 1919, and did duty during the war with hospital ships and the Indian Hospital at Brighton. Mentioned in despatches he received the 1914-15 Star, British War and Victory Medals.

POYNDR.—In Fleet, Hants, on Dec. 13, 1942, Lieut.-Colonel George Frederick Poynder, R.A.M.C., Retired. Born Dec. 23, 1851, he took the M.R.C.S. in 1874 and the L.R.C.P. in 1875. Commissioned Surgeon March 6, 1880, he was promoted Surgeon Major March 6, 1892, Lieut.-Colonel R.A.M.C. March 6, 1900, and retired August 29, 1900. He held the Retired Pay appointment at Bedford from 1901 till 1917. He was also M.O. to the Mildmay Mission to the Jews.

Journal

OF

THE

Royal Army



Medical Corps

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MONTHLY

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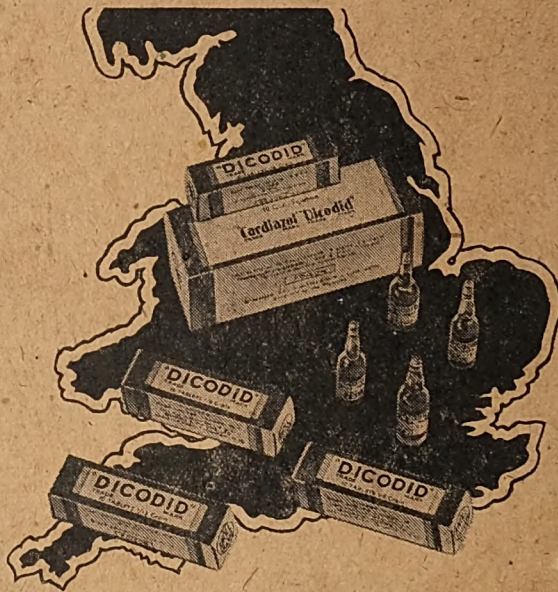
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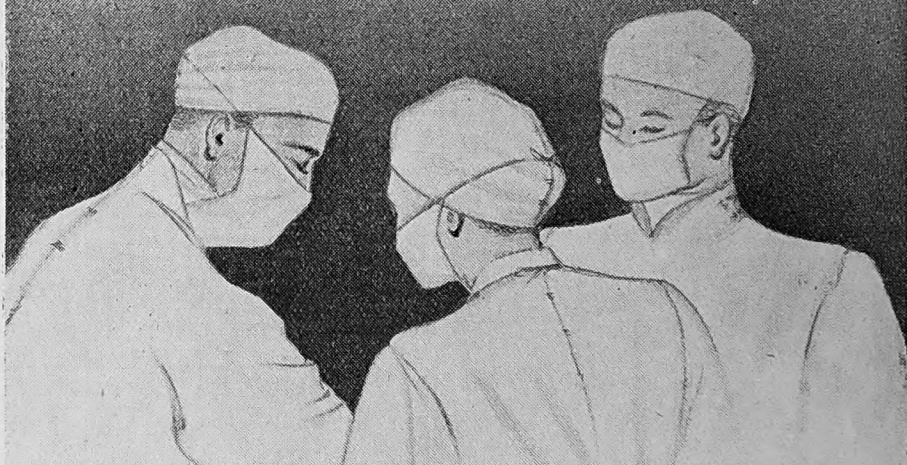
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[1]. "Treatment of Burns by Envelope Irrigation." *British Medical Journal*, July 12th, 1941, p. 47.

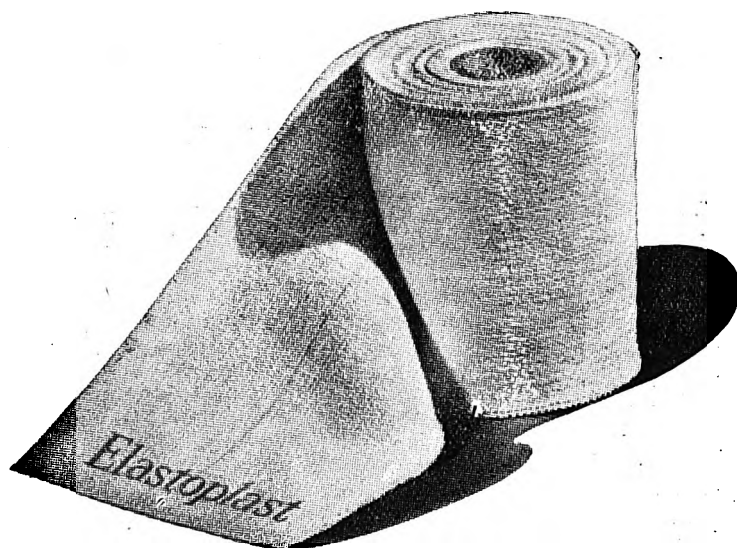
[2]. "Experiences in an E.M.S. Base Hospital in the London Area," *Edinburgh Medical Journal*, January, 1942, pp. 25-26.

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